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METHODS AND RESULTS OF A CLASS EXPERIMENT IN LEARNING

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I. THE CONDITIONS OF THE EXPERIMENT

In an article in the first volume of this JOURNAL[1], a series of experiments in learning was suggested for class use. The present article gives the results of one of these experiments—namely, on the effects of practice—as conducted with a class of about thirty-five students in educational psychology. Instead of the digit-letter substitution proposed for the practice series in the former article, the practice consisted in learning to write an old civil war code[2]. For convenience of reference, it is reproduced below (Figure 1). As a test of intelligence, the code is usually used but once, *i. e.*, to transcribe a short phrase or sentence. In the present experiment, long passages of connected prose were translated into the figures of the code in an attempt to increase the speed with which the code could be written. The passages were the same as used in the article above

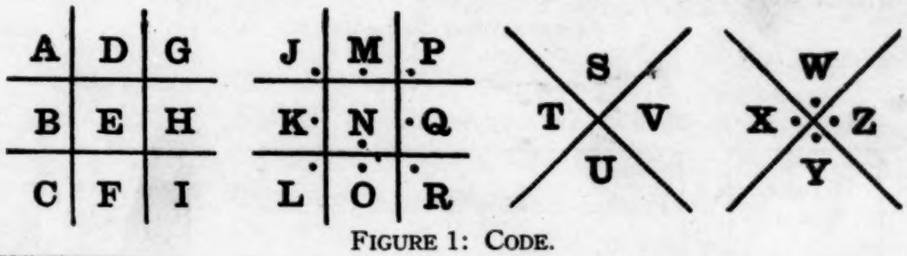


FIGURE 1: CODE.

[1]Vol. 1, pp. 373–384.

[2]This code is described by Healy and Fernald in their "Tests for Practical Mental Classification," Psychological Review Monographs, Volume XIII, No. 2, Test No. XI, and has been used as a test by Goddard, Terman and others, in the various revisions of the Binet-Simon Tests. Compare TERMAN *"Measurement of Intelligence,"* Chapter XIX, pp. 330–332.

referred to and the general arrangement of the printed form was similar. The first few lines of a sample practice sheet with the characters filled in is reproduced below (Figure 2). The code was printed on small library cards, and as noted below, was used in one of the preliminary tests. The general principle on which the code was constructed was then explained and the cards collected. In the practice proper the printed code was not used, the subjects being required to reconstruct the code mentally as they wrote,—in exactly the way in which the code was undoubtedly intended to be used originally. The use of the same passages and general arrangement followed in the digit-letter substitution described in the above noted article was for the purpose of comparing the practice curves in these somewhat different sorts of learning.

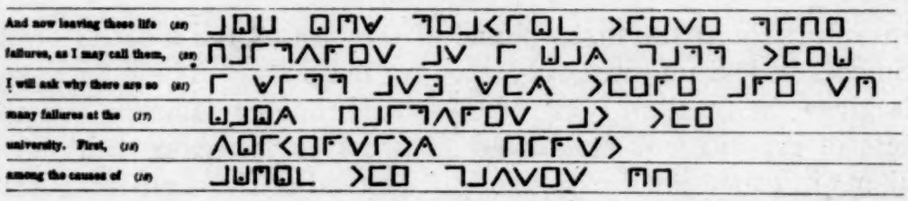
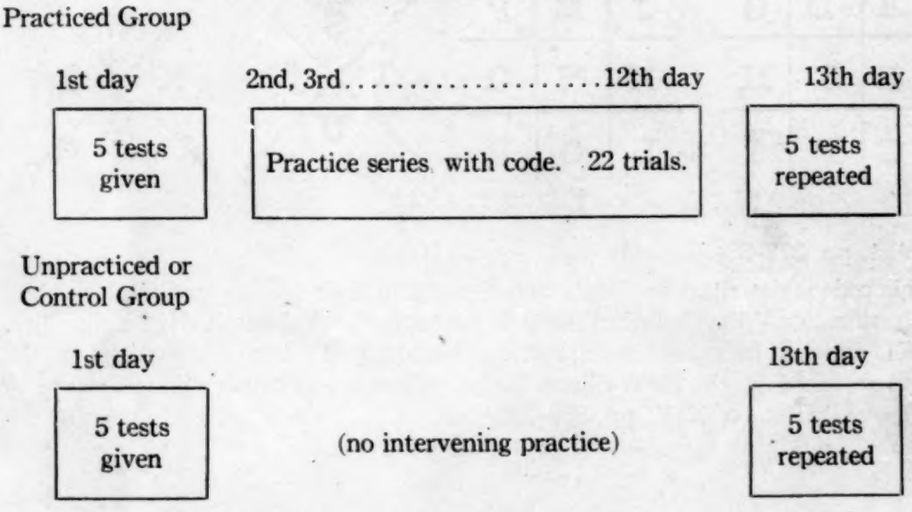

And now leaving these life (10)
failures, as I may call them, (20)
I will ask why there are so (31)
many failures at the (37)
university. First, (44)
among the causes of (50)

FIGURE 2: PRACTICE MATERIAL

Before and after the practice series, the subjects were given a group of five closely related tests with a view to noting the possible effect of the practice gains in the use of the code on what might appear to be similar activities. Two control groups were given these tests, but without the intervening practice with the code.

The general plan of the experiment may be illustrated by the following diagram.

AN EXPERIMENT IN LEARNING



The practiced group was a class in educational psychology. Two control groups were used,—a class in teaching and one in school administration. The five tests to be described below were given to each group of students on two separate occasions, twelve working days apart, and in the interim the class in educational psychology was practiced twenty-two times in the use of a code. (The interval between the giving of the five tests and the repeating of these tests should be the same in all the groups. Circumstances, however, made this impossible in the present experiment. The interval for the practice group was sixteen calendar days; for the class in teaching, nine days; for that in administration, nineteen days.)

The five tests were as follows:

(1) Digit-Symbol Substitution. This test is the same as the one described in the former article and similar to the one described by Whipple in Test 37B of his *Mental and Physical Tests* (revised edition). The printed sheets of paper were distributed. At the top of each sheet are ten circles, containing the ten digits in order, and in each circle is a simple symbol for the digit therein contained. Below are columns of five-place figures. These figures are to be translated into the symbols. The score is the number of substitutions made in two minutes.

(2) Complex Dotting. Sheets of paper were ruled into squares, each square containing either the number 1, 2, or 3, these numbers being distributed at random. The task was to put in each square the designated number of dots, the time allowed being one minute. The score is the number of squares completed. There are one hundred and fifty squares. The first six rows of squares are reproduced in Figure 3.

(3) Number Code. The top of each sheet contained a simple code for the nine digits. Below was a series of sixty characters which the students translated by means of the code. The time taken to complete the translation was recorded[3].

(4) Digit Letter Substitution. Sheets of paper were distributed, each containing at the top circles in which were inserted numbers from 1 to 26. Each circle also contained a letter of the alphabet, the

[3]The test is one used by Brunner and McMillan in the Child Study Departmens of the Chicago Public Schools and is described by Healy and Fernald in the Psychological Review Monographs, Volume XIII, No. 2, Test No. X (Cross Line Test, B).

2	3	1	2	1	1	2	3	2	2
1	1	2	1	3	1	2	3	3	2
3	2	3	2	2	1	3	1	2	3
1	3	2	3	1	1	2	1	3	1
2	1	3	2	1	3	2	3	3	2
1	3	2	1	3	1	2	2	1	1
2	3	1	2	1	1	2	2	1	3

FIG. 3: TEST 2.

twenty-six letters being distributed at random. Under this code were printed sentences, and the task consisted in translating letters into digits for a period of five minutes. These blanks are the same as those used for the practice series in the article above referred to,[4] but with a somewhat simpler text.

(5) Letter Code Translation. The test consists of a sheet of paper containing forty-two simple characters which, by means of a code printed upon separate cards and distributed to the students, can be translated into English sentences. Reproductions of the two code passages used, one before and one after the practice, are given in Figure 4 (a) and (b). The first passage, when translated, reads: "Come quickly. Bring men and supplies for journey. x. y. z." The second passage reads: "Enemy on the march. Meet them at river. Hurry forward. M." The code used is reproduced in Figure 1. The time needed to make the translation was recorded as the score.

The second trials in the above five tests were held in exactly the same way except that new material of equal difficulty was used in the translation and substitution tests.

The practice series was as follows: Using the same code as that employed in test No. 5 above, and reproduced in Figure 1, sheets

[4] This JOURNAL. Vol. I.

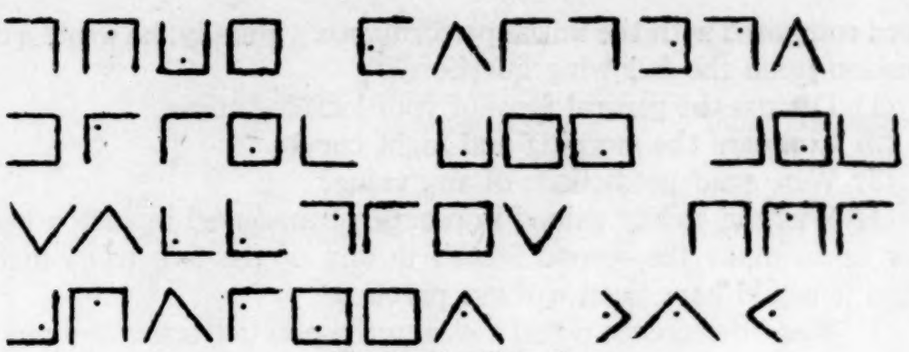


FIGURE 4a: TEST 5.

come quickly
bring men and
supplies for
journey xyz

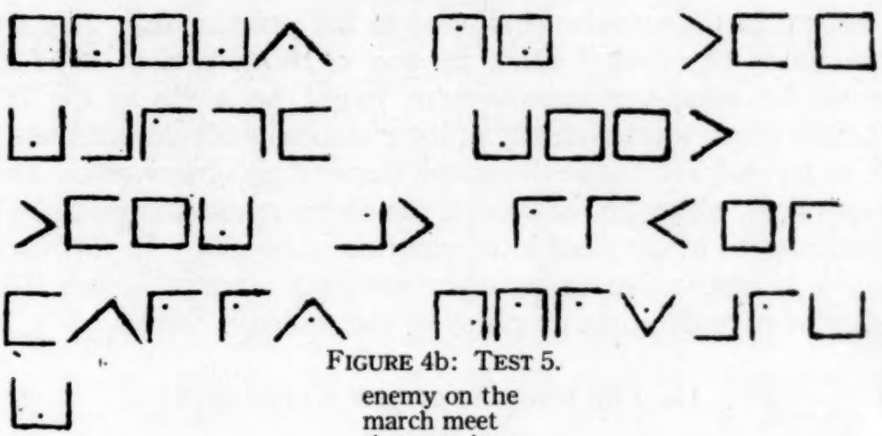


FIGURE 4b: TEST 5.

enemy on the
march meet
them at river
hurry forward
m

of printed material were distributed and the subjects were asked to translate the English sentence into the code. After the scheme on which the code is constructed had been explained, the subjects, as noted above, were required to reconstruct the code mentally instead of using the printed key. Each trial was five minutes long, one trial being made in the morning of each day and one in the afternoon. The first test and the twenty-second test were taken in class; the others at home. Before taking each test the student was asked to record the date, the time of day, his mental and physical condition, and his expectation as to gain or loss. After the test, he recorded the number of letters translated and the gain or loss over the previous performance.

At the conclusion of the experiment each student made up his learning curve on cross section paper. In addition, he made a separate graph of the morning and evening performances and computed his percentage of gain in the practice series—the highest re-

cord compared with the initial performance. Finally, he wrote a discussion upon the following questions:

(1) Discuss the general form of your learning curve.
(2) Compare the morning and night curves.
(3) Were your predictions of any value?
(4) Was the ability gained in practice transferred in such a manner as to make the second record in any of the five trials higher than it would have been without practice?
(5) Was interference noted between the practice series and any of the tests?
(6) Criticize the experiment.

It was the intention, as may be seen from the above description, to have several tests in the preliminary and final series so similar in nature to the exercise employed in the practice that they would presumably be affected either by way of reinforcement or of interference by whatever improvement might be made in the latter. Whether it is a matter chiefly of interference or of reinforcement was left to the subject to decide on the basis of his observations and introspections, although, of course, the scores made needed to be taken account of in the final interpretation of results. In this connection, it is instructive to have the subjects attempt before the experiment to make some prophesy of the probable results.

II. The Results of the Experiment

The following scores were obtained in the preliminary and the final trials of the five tests. These scores are given for the three classes tested. The first tabulation, that for the practiced group, contains also the scores for the initial and the highest performances in the practice series. As the figures represent in three cases the number of substitutions, etc., made in a given time and in the other two tests the time (in seconds) necessary to complete the test, the facts may be restated for convenience of reference.

Test No. 1. Number of substitutions of symbols for digits in two minutes.

Test No. 2. Number of squares dotted in one minute.

Test No. 3. Time (in seconds) necessary to complete number-code test.

Test No. 4. Number of digits substituted for letters in five minutes.

Test No. 5. Time (in seconds) necessary to complete translation of code passage.

TABLE I

Practiced Group

Scores in Tests and in Practice Series

Student	CLASSROOM TESTS										PRACTICE SERIES		
	Preliminary					Final					Init.	High	Gain
	1	2	3	4	5	1	2	3	4	5			
1	59	106	110	91	160	76	113	85	87	135	49	147	98
2	80	116	90	134	120	82	135	65	162	65	52	244	192
3	51	62	130	87	180	61	87	95	82	90	45	209	164
4	70	128	145	110	155	93	145	75	110	105	30	184	154
5	66	116	95	294	180	72	123	80	294	110	44	279	235
6	97	112	85	168	85	98	122	65	189	65	93	300	207
7	47	78	180	53	180	56	91	115	56	100	22	161	139
8	49	110	105	94	175	67	137	90	111	85	16	237	221
9	53	111	135	85	145	80	121	90	104	105	36	195	159
10	65	110	90	88	115	68	127	80	106	115	95	285	190
11	60	95	75	98	120	68	105	70	130	70	29	205	176
12	46	80	180	77	180	65	96	125	96	170	43	265	222
13	61	115	75	123	100	71	118	85	124	95	66	346	280
14	55	95	95	72	180	67	113	80	106	105	38	293	255
15	20	103	120	123	135	53	116	90	143	145	22	296	274
16	75	90	105	109	110	75	100	70	121	90	52	279	227
17	56	83	75	112	95	79	90	70	122	95	73	252	179
18	66	97	100	101	90	74	111	70	128	75	49	259	210
19	59	100	95	122	180	55	109	85	125	100	26	178	152
20	51	92	120	74	180	49	111	85	76	65	33	221	188
21	55	100	110	98	125	75	113	75	135	110	57	236	179
22	47	101	100	94	180	75	116	80	105	120	30	232	202
23	66	103	180	135	170	87	123	90	192	115	36	278	242
24	53	100	110	109	180	45	102	100	110	145	30	176	146
25	55	110	180	123	145	67	126	130	114	110	50	274	224
26	41	110	80	92	85	47	122	70	95	65	46	217	171
27	56	85	110	121	145	64	88	95	109	155	34	225	191
28	52	98	90	70	135	62	114	80	82	70	24	281	257
29	54	96	115	121	100	67	95	75	142	95	55	282	227
30	65	97	115	99	135	80	109	85	122	60	47	287	240
31	35	111	180	114	180	75	117	80	135	180	40	297	257
32	33	74	180	74	155	47	93	80	92	90	27	190	163
33	70	120	150	80	120	73	122	85	97	100	36	210	174
34	58	103	115	103	165	70	123	75	119	85	20	166	146
35	56	110	75	97	120	66	121	70	103	100	52	171	119
Ave.	57	101	117	107	143	69	113	84	121	102	43	239	196
A. D.	15	11	27	24	22	9	8	11	26	22	14	42	39

TABLE II A

Control Group Number 1

Scores in Classroom Tests

Student	Preliminary					Final				
	1	2	3	4	5	1	2	3	4	5
1	56	121	100	110	140	71	121	75	135	150
2	59	99	150	173	125	73	105	90	198	85
3	58	68	170	92	155	56	83	110	106	145
4	68	110	110	93	175	70	118	90	123	135
5	81	85	120	118	125	82	107	80	167	105
6	55	108	180	104	180	41	101	165	111	140
7	63	108	120	77	170	65	100	100	139	120
8	88	130	80	101	65	83	136	65	134	90
9	66	102	90	119		73	95	85	138	
10	72	127	105	208	110	69	123	100	220	145
11	75	120	115	54	165	75	132	85	84	165
12	48	100	105	103	165	60	115	95	100	137
13	69	97	130	113	180	63	99	100	143	180
14	75	97	100	164	165	77	112	80	195	130
15	66	93	100	95	150	70	109	85	121	125
16	105	126	65	205	75	104	136	60	219	75

TABLE II B

Control Group Number 2

Scores in Classroom Tests

Student	Preliminary					Final				
	1	2	3	4	5	1	2	3	4	5
1	60	76	105	101	150	74	84	75	128	110
2	50	110	120	113	140	73	120	90	120	95
3										
4	41	87	130	87	180	49	92	110	84	180
5	58	93	90	103	140	64	103	85	96	115
6	27	80	150	77	180	67	103	80	112	130
7	29	70	180	39	95	52	82	155	43	180
8	57	102	105	115	165	66	105	95	135	110
9	71	110	100	106	120	78	110	70	117	85
10	65	72	120	114	85	60	70	95	104	105
11	65	85	130	95	130	75	95	90	129	115
12	33		140	70	115	42		110	63	115
13										
14	55	118	145	67	170	63	127	105	99	155
15	59	102	115	98	105	67	102	80	115	95
16	73	121	90	119	115	85	135	75	130	75
17										
18	65	116	110	97	115	81	120	75	116	95
19	65		125	110	180	80		130	90	140
20										
21	61	100	130	71	170	65	92	95	89	125
Av. (*)	62	101	119	106	141	69	108	93	124	124
A. D.	11	14	20	24	28	9	7	21	28	24

*The two control groups are considered as one for these averages.

TABLE III

Differences Between Averages of Practice and Control Group at the Start of Experiment (Results Stated in Terms of Superiority of Practiced Group to the Control Group)

Test 1	Test 2	Test 3	Test 4	Test 5
−5 (9%)	0	+2 (2%)	+1 (1%)	−2 (1%)

Table III shows that the differences between the practiced and control groups in the preliminary trials are, with the possible exception of the results in Test 1, so slight that the groups may be considered of equal abilities in the tests at the start and therefore comparable groups. The fairest method of comparing the two groups at the end of the experiment is to figure, in each case, from

the average of the performance of all individuals (*i. e.*, in both groups) in these preliminary tests. That is, we may consider that the slight differences between the groups at the start are chiefly due to chance errors of selection and in methods of giving tests, and that the average of the records of all individuals tested is nearer to the true average than the averages of either of the two groups. The results are given in Table IV A and B.

TABLE IV A

Average Records of All Individuals (i. e., Both Practice and Control Groups) in Preliminary Tests

	Test 1	Test 2	Test 3	Test 4	Test 5
Av.	59	101	118	107	142
A. D.	11	12	24	24	29

TABLE IV B

Gains of (I) Practice Group, and (II) Control Group, in Final Tests (Compared With the Common Average of Both Groups in Preliminary Trials as Given Under A)

	Test 1	Test 2	Test 3	Test 4	Test 5
I	10 (17%)	12 (12%)	34 (30%)	14 (12%)	40 (28%)
II	10 (17%)	7 (7%)	25 (21%)	17 (14%)	18 (13%)
I–II	0	5%	9%	−2%	15%

The initial and highest records made by the practice group in the practice exercise are given in the last two columns of Table I. The practice exercise, as above described, consisted in translating sentences into code and was continued for approximately two weeks. The figures represent the number of code symbols written in the practice periods of five minutes. The average number at the start was 43, and the average of the highest records made was 239, a percentage of 537%. Although this improvement in the facility and speed with which the code could be written was considerable, the effect of this newly acquired skill on similar accomplishments was, if we may judge from the results of the control group which has no such practice, insignificant in at least certain of the tests. The results cannot, however, be taken altogether at their face value and need interpretation.

The comparisons in question are made in Table IV B. The control group in the second trial (after an interval corresponding in length to that in which the other group was engaged in practice)

did quite as well as the practiced group in one of the tests (Test 1) and even slightly better in another test (Test 4). In the three remaining tests the practiced group excelled the unpracticed or control group to the extent of 5, 9, and 15 per cent, respectively (tests 2, 3, and 5). These percentages are not, however, directly comparable. In Test 2, the percentage represents an increase in the number of operations made; in Tests 3 and 5 they are percentages of the decrease in the time necessary to do the tests.

The three tests, 1, 2,, and 4 in which the amount of improvement is computed in terms of the number of operations performed in a given time, may be considered first. This method of computation is the same as that followed in the case of reckoning the improvement in the practice exercise, the single operation,—in the first test substituting a symbol for a digit, in the second test the placing of a set of dots in a square, in the fourth test substituting a digit for a letter, and in the practice exercise substituting a code sign for a letter,—is made the unit of measurement. The question at issue is, then: Are these units equal? If they are not equal, the percentages of improvement reckoned on the basis of them are not comparable.

Specifically, the question is: Is 537% of improvement in substituting code symbols for letters equivalent, or approximately equivalent, to 537% of improvement in substituting numbers for letters?

If it is, it is at once possible to draw valid conclusions in regard to the question of the "transferability" of this improvement to other tests, *e. g.*, if there is total "transfer" we should expect to find an improvement of 537% in the digit letter substitution test as a result of the practice. Or if there is only partial "transfer" that would be indicated by the corresponding percentage.

It is to be remarked, in the first place, that there is no question but that each of these so-called units varies in the course of the experiment. It is, for example, much easier to substitute a digit for a letter towards the end of the practice than it is at the start, but both operations count "one" in reckoning the practice gain. It would, of course, be advantageous if we were dealing with "units" which did not vary, but even that is not essential for our comparison. It is simply necessary that the units in the two or more performances which we are comparing are *on the average* equal, or that we can equate them by, *e. g.*, determining how much larger or smaller one of these units is on the average than the other.

This, we think, can be done by noting the relative amounts of improvement that comparable groups of subjects can make in the same time and under the same experimental conditions in each of the tests or practice exercises. It would, of course, be preferable if the two or more groups could be practiced until the physiological limit was reached in each case—that is, until a point is reached beyond which prolonged practice does not lead, *on the average*, to any further progress. Such a level would be similar to that reached by expert stenographers or newspaper telegraphers. When one attempts to make comparisons before this level is attained he can never be sure that in one group the last few practices may have, *e. g.*, included a "sudden gain" period which has not yet been reached in the other practice. However, fairly accurate comparisons can be made on the basis of the shorter periods of practice.

In the present experiment this matter has been controlled in the case of but one of the tests. A similar class of students in the year preceding that of the experiment now being reported used the digit letter substitution test as practice material. They practiced for the same length of time as in the present experiment, and in five minute periods. A point was then reached at which the *average* improvement or fluctuations from day to day were not appreciable, and a similar point was also reached by the group in the above described practice with the code. The average percentage of improvement up to this point in the digit letter substitution is in the neighborhood of 270%.[5] It is now possible to argue that, if there is such a thing as total "transfer" of skill from one accomplishment to another, the approximately 500% of improvement made in the code practice should be evidenced by a gain of approximately 270% in the last trial of the number-letter substitution test. As a matter of fact the actual per cent. of improvement recorded in this test is 12%, which is actually two per cent. less than the gain made by the unpracticed or control group. In other words, the effect of the practice in the code in the ability to substitute digits for letters would appear, as far as these figures are concerned, to be practically nil.

The figures do not, however, tell the whole story. The introspections and observations of the subjects show that the one operation has at least interfered with the other, as observed in the tendency to

[5] This percentage is based on the records of twenty-two cases.

substitute a code symbol in place of a digit in the latter test. As a matter of fact there is doubtless an interplay of facilitation and interference, which the above used term "transfer" utterly fails to describe. The expression, it may be remarked in passing, is, in general, not a fortunate one; it has a faculty psychology connotation, and, as in this case, does not serve to differentiate between what are unquestionably very different processes. For example, the speed and skill of manipulation and the general conformity to the conditions of the experiment acquired in the code practice may very well have facilitated the performance of the digit-letter substitution test; whereas, other factors such as the specific forms of association just mentioned, to wit, digit-letter and symbol-letter substitution, may have interfered with each other to such an extent that an improvement which might have resulted from the first mentioned factors has been counterbalanced by the interferences set up by the second set of factors. In the present case, in view of the performance of the control group, it might well be argued that the interferences have in fact somewhat overbalanced the factors which otherwise might have facilitated the performance of the test. The total result, as measured by the work accomplished, remains, however, nil.

The same explanation may be made of the findings in digit-symbol substitution test (Test No. 1). In the complex dotting test (Test No. 2), there is a somewhat larger percentage of improvement made by the practice than by the control group (5%). In this case, there would appear to be relatively few factors making for interference, and the gain is doubtless due to the increased speed of manipulation acquired in the code practice. This latter factor is an illustration of the so-called "identity of substance." This term is also a rather unsatisfactory one. It is a somwehat imposing expression to describe so simple a fact, and savors, as does the word "transfer," of a faculty psychology.

In the complex dotting test, as in the digit-symbol test, the general limits of possible improvement in a single period of practice comparable to that of the code practice have not been determined, but it is apparent from the similar nature of all the tests at present under discussion that but a small part of the possible improvement has been realized as a result or effect of the code practice.

In Tests 3 and 5, both code tests, there appears to be a more considerable effect produced by the practice exercise in writing code symbols. This might have been anticipated in view of the com-

mon factors involved. What fractions of the total possible effect are represented by these percentages, it is hard to estimate. A certain fraction of the time must be used in writing down the translation, which would remain as a practically reducible minimum, whatever the improvement which might be made in the speed of translating the code. In accurate statements as regards the comparative amounts of facilitation or interference, the same procedure would be necessary as described in the case of the digit-letter substitution test.

The above comparisons have for convenience of discussion been carried out in terms of percentages. As the percentages of improvement are very evidently affected by the level at which the practice begins (*e. g.*, 50 – 100 = a gain of 50 = 100%, 100 – 150 = a gain of 50 = 50%), it is a mooted question as to whether or not it is preferable to make the comparisons in the absolute amounts of gain. It may be preferable in equating the units to compare the average amounts of actual gain in the two practices. In the above case, where the figures are available, the difference between the averages of the initial and highest records in the code practice is (239 – 43 =) 196, and the difference in the case of the records of twenty-two individuals in the digit-letter practice is (291 – 108 =) 183. The averages of the individual gains in the two cases are 196 and 181, respectively. On this basis of comparison, the units used to measure progress in the two practices are on the average approximately equal. The general conclusions remain unaffected by this method of comparison.

The above considerations should make evident how meaningless are the conclusions of investigations on this subject which have employed the percentages or other methods of comparison for stating the findings without proposing any method for equating the measures used.

The following coefficients of correlation have been calculated from Tables I and II.

CORRELATION COEFFICIENTS BY SPEARMAN'S "FOOTRULE" FORMULA

TEST	I	II	III	IV	V
(1) Rank Correlation between percentage gain in code practice and tests.	16±7	21±7	7±7	4±7	35±7
(a) Rank Correlation between absolute gains in code practice and absolute gains in tests	15±7	3±7	4±7	24±7	−11±7

(2) Rank Correlation between preliminary and final tests					
(A) Practiced Group	44±7	66±7	39±7	65±7	24±7
(B) Control Group	50±8	62±8	51±8	54±8	36±8

Average, Practiced Group 47.5±7; Control Group 49.6±8

(3) Rank Correlations between					
(a) Initial Record of practice in code vs. preliminary records in tests	23±7	9±7	21±7	13±7	37±7
(b) High Record of practice in code vs. final records in tests	14±7	5±7	5±7	32±7	−3±7
(c) Initial Record of practice in code vs. final record in test 5					+2±7
(4) Rank Correlation between initial and final record in practice					32±7

The correlations under (I) show that there is, in general, but little relation between the individual percentages of gain made in the practice and those made in the tests. The largest correlation is with the translation from code tests. The largest correlation is between the gains in the practice and those in the code test.

The correlations under (2) show that there is a fair amount of relation between the standings of the subjects in the preliminary and final trials of the tests, averaging in the case of the control group 49.6%, and in the practiced group a little less, 47.5%. There is comparatively little difference between the two groups on the whole, although there is some irregularity in the separate tests.

The correlations under 3a and b show what relation existed at the start between the standing of individuals in the practice exercise and in the test series and what at the end of the practice. Under both 2 and 3, a number of comparisons may be made, although the findings are not altogether consistent. The number of cases is doubtless too small, and the chance errors, in general, too great to make these detailed comparisons of value, except for purposes of illustration of methods. The results in the case of the fifth test are

worth calling attention to, however. It is quite likely that not enough time was allowed in this test to bring out the relations between the process of translating from the code and that of translating into code, and that, therefore, the coefficients of correlation found are not altogether reliable. They would appear to point to a considerable difference in the abilities of students in the two performances. The difference may be similar to that which exists between translating a foreign language into one's mother tongue and composing in a foreign language. There may very well be considerable differences in the relative abilities of students in these two processes. The subject is worthy of further study. As far as the results here go, they show (1)(see average in Table I and correlations under 1) that practice in writing code has improved to some extent the general ability of the group in the reverse process of translating from the code into English. That (2) there was less relation between the standings of students in the preliminary and final trials of this test than of any of the other tests. (That this statement holds true of the control group as well (R = 33) would simply argue that the two passages used for translation were not of comparable difficulty,—the discrepancy is, however, greater in the practiced group (R = 24). That (3) while there is a fair amount of relation (37 ± 7) between the initial record of the practice test in writing code and the preliminary test in the translation of code, there is at the end of the experiment a slight inverse relation ($R = -3, \pm 7$). One other fact needs to be considered in this connection, namely, that the rank correlation between the initial and highest records made in the practice series was $R = 32, \pm 7$. These results as a whole, in view of the various possible sources of error, can hardly be used except to illustrate the problem and the methods of attacks.

In the accompanying plates I to IV, certain characteristic curves of learning are reproduced. These have been selected from the graphs plotted by each individual from his trials in the practice series. Taking the graphs as a whole, they may be roughly classified on the basis of the rapidity of the initial progress into three groups: (1) rapid initial rise, with slower subsequent progress, *i. e.*, smaller gains towards end of practice (convex to base line), Plate I; (2) slow initial progress followed by later acceleration (concave to base line), Plate II; (3) rectilinear, *i. e.*, even acceleration from start to finish, Plate III. In Plate IV there are reproduced a number of

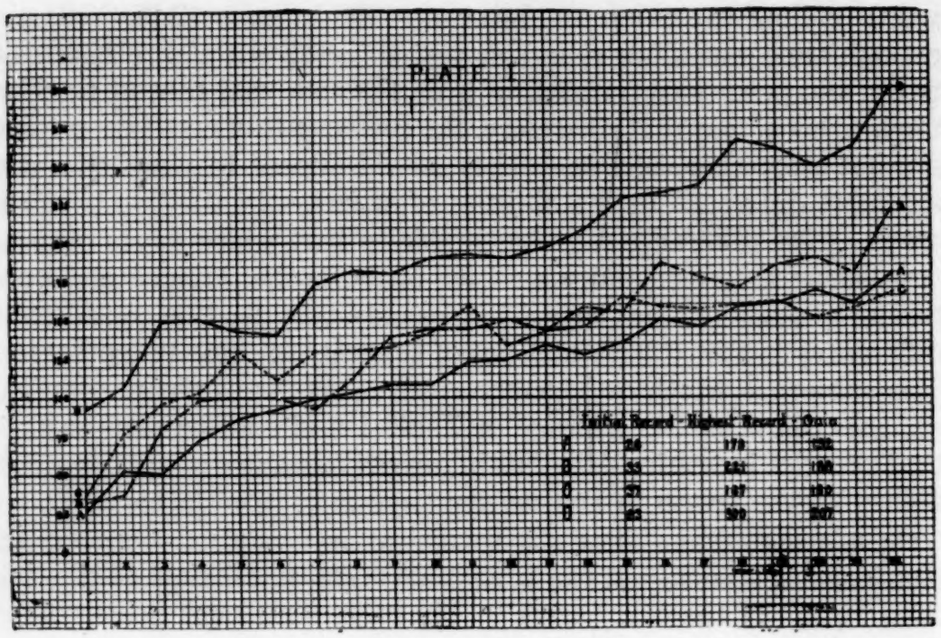


PLATE I

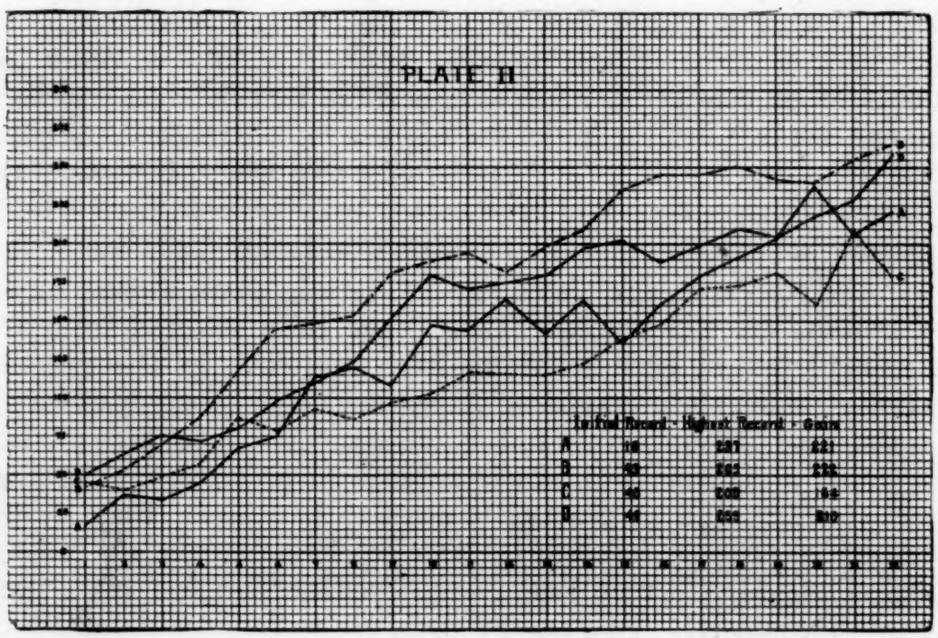


PLATE II

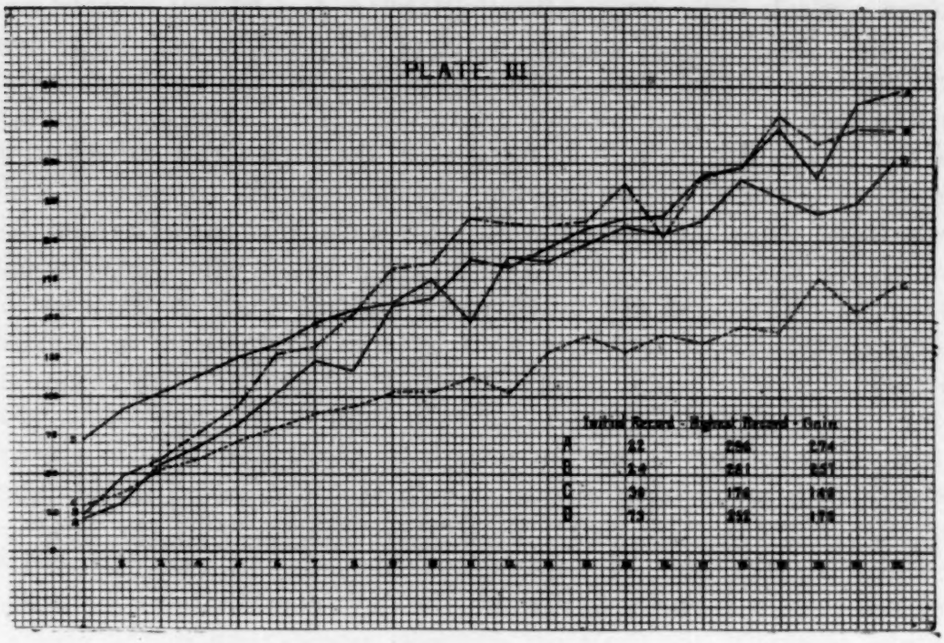


PLATE III

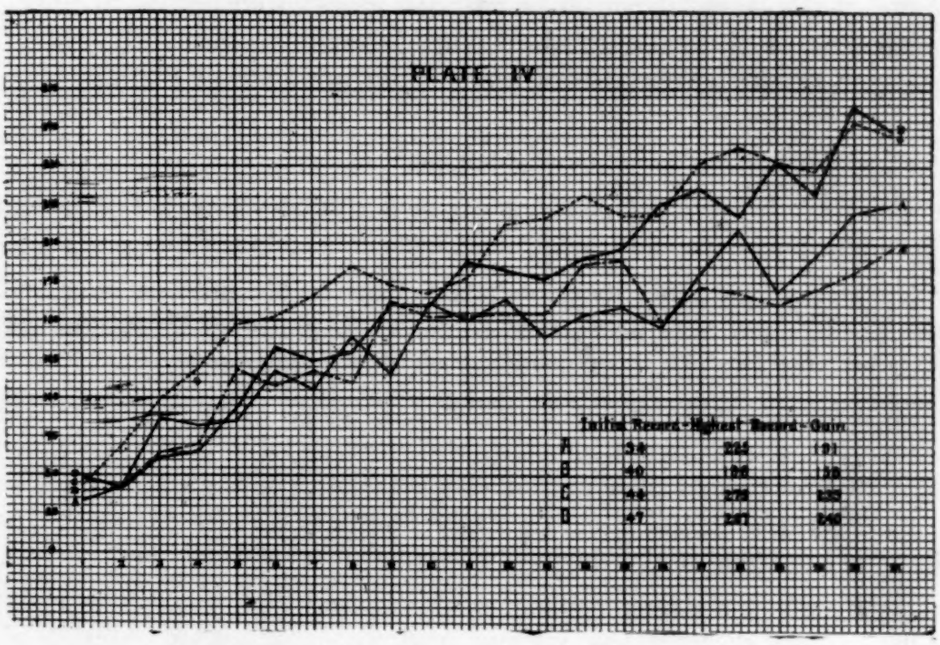


PLATE IV

curves, which show various peculiarities, *e. g.*, frequent fluctuations or "ups" and "downs" in the course of the practice, etc. The prevailing type in this code practice approximates the rectilinear with a tendency to a small initial acceleration. The initial gains are not so marked in this form of learning as in the digit-letter substitution practice discussed in the previous article, referred to above. This was to be expected, since the initial associations to be formed between the characters of the code and the letters and words of the passages transcribed are much more difficult than in the case of the associations of numbers with letters. Plateaus or prolonged periods in which there is little or no apparent gain are very common, and on the whole, of greater duration than in the digit-letter substitution practice. They are usually not followed by the abrupt or sudden gains of large amount which are often noted in the later practice curves. This again illustrates differences in the kind of learning or the sort of associations formed. In the digit-letter substitution, it is easier to acquire the digit combinations for whole words, especially for the most common words, than in the present practice. A few of these combinations, when acquired, enable the learner to leave his former level of practice as if with a leap. It is altogether likely that were this practice in the code carried out for a longer period than was done in the class experiment that the same phase of the learning would be reached more often and with the acquirement of the code combinations for whole words, the rate of progress would be capable of more rapid advance at certain stages of the learning.

SUMMARY

Some of the general principles which may be illustrated by the experiment are the following:

(1) *Individual Differences.* If the class is of sufficient size, the results obtained may be plotted to show the range of individual differences and the effect of practice on these differences.

(2) *Characteristics of the Curve of Learning.* The results of the series of practices, when plotted, will show, in the curves of many individuals, some of the common characteristics of the learning curve, *e. g.*, the rapid initial rise, the daily fluctuations, the plateaus, and the general form of the curves, as concave, rectilinear, and convex.

(3) *Effect of Various Factors on Individual Progress.* The effect of interest, of distractions, fatigue, and rest, *e. g.*, of the Sunday in-

terval, may be studied in the curves of various individuals. The optimal length of the work period, the optimal length of the interval between the work periods and the effect of the time of day, *e. g.*, morning, afternoon, or night, on the scores, may be illustrated by dividing the class into sections and varying these factors.

(4) *Correlation.* Where several kinds of tests are used, class scores may be tabulated and various correlations computed. In certain cases evidences of negative correlation or interference may appear.

(5) *Characteristics of the Curve of Re-learning.* After the practice series has been completed and an interval of time has elapsed, a re-learning series may be conducted and the relearning curve compared with the curve of original learning.

(6) *Facilitation or Interference as a Result of Practice.* In this experiment, the problem was specifically to determine whether the practice series had any effect upon the ability to the students in five other special tests. An unpracticed or control group is needed in order to test this question.

Conclusions

It is, of course, not expected that a class experiment of this nature will prove, or disprove, educational theories which are still in dispute and in regard to which experimentation is still incomplete. The experiment does, however, illustrate the problem in a concrete way and produce in the matters of individual differences, correlations, and transfer, results which are of interest.

It appears from the figures we have given that there is a positive correlation of small amount between the first tests and the final tests of students in the practice series. In other words, the students tend to hold the same relative rank in the first trials as in the last trials of the practice. This agrees with the usual findings that to those who have shall be given, *i. e.*, that those who excel at the start retain after practice their superior position. The inverse holds for the inferior students, at least to the extent that they remain inferior in rank.

In general, the correlations found between gain in the practice exercise and gain in the tests are positive, although small. The negative correlation in the case of the fifth test seems to argue for some interference between the facility gained in translating English passages into the code and the reverse process of translating the code into English.

Finally, the conclusions to be drawn from the comparative gains in the test and practice series agree in general with those of more extensive experiments on the general effect of practice.

In class experiments of this sort, it is necessary that materials be used in which the student is not already practiced and in which it is possible to improve within a relatively short practice. It would be desirable if the particular exercises chosen for the classroom tests and for the practice series represented tasks less artificial and more useful than those discussed in this experiment, and it is possible to plan such tests. Tests may be arranged in the use of the higher tables of multiplication, in using a table of squares or square roots, in learning the short methods of multiplication, in learning the use of stenographic characters, or in correcting faulty proof by means of a key of proofreader's marks. Some of these suggestions may be tried out with subsequent classes.

CERTAIN ABILITIES FUNDAMENTAL TO THE STUDY OF GEOMETRY[1]

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Success in the formal demonstration of a theorem of geometry depends upon, at least, four abilities, namely:

1. The ability to draw a figure for the theorem.
2. The ability to state correctly and accurately the hypothesis and conclusion of the theorem.
3. The ability to recall additional facts about a figure when one or more facts are given, and
4. The ability to select from the available facts those that are necessary for a proof, and to arrange them so as to arrive at the desired conclusion.

The purpose of this investigation is three-fold:

1. To determine the relation of each of these four abilities to teachers' marks. This should, in turn, determine either the extent to which teachers value these abilities, or the degree to which they are able to base their marks on the things which they do value.
2. To determine the extent to which these abilities are developed in the various schools included in this investigation.
3. To develop tests which may be used for the purpose of diagnosis; that is, for the purpose of determining whether or not the weakness of a class is due to the lack of development of one or more of these abilities.

For these purposes four tests, (to be known as A, B, C, and D), have been developed, each testing one of the abilities in question. An effort has been made so to arrange each test that it will measure only one of the four abilities. Thus, Test A consisted of geometrical exercises for which the pupil was asked to draw the figure. In Test B the exercise was stated, and the figure drawn. The pupil was then asked to state the hypothesis and conclusion. In each exercise of Test C a figure was drawn, and certain facts about it were given, and the pupil was to add as many more facts as he could. The purpose of Test D was to measure the pupil's ability to select and organize facts so as to produce a proof. In order to eliminate

[1] A complete report of this investigation will be issued in book form later.

the factors involved in the other three tests the figure was drawn, the hypothesis and conclusion were started, and a list of facts, including those necessary to the proof, was given. The pupil was then asked to give the proof.

This investigation was limited to classes which had recently completed the first two books of geometry. If more advanced classes had been included, it would have been necessary to limit the investigation to these advanced classes, or to use a separate series of tests. The time required in developing a second series of tests made the latter method of procedure impracticable. To limit such an investigation to the advanced classes is to deal with a specially selected group of pupils since extensive elmination had taken place in the earlier work. On the other hand, if the abilities in question are of value, it seems that they should be fairly well developed during the first two books of geometry Also if the tests are to be used for the purpose of diagnosis it should be possible to apply them fairly early in the study of the subject, while there is yet time to remedy any difficulties which may be found to exist. Hence the tests were given to only those classes which had recently completed the first two books of geometry.

Each of the four tests was given to not less than one thousand pupils. In all, the tests were given in sixty-three schools, distributed throughout the East and the central West. The wide distribution of schools and the variation in the nature of the schools insured the inclusion of nearly every type of high school pupil in the investigation. Clearly it was impossible for the author to conduct the tests in person. However, the nature of the tests made it possible to formulate simple and definite directions which insured a fair degree of uniformity. In order to be sure that the pupils would understand these directions, the author tried them out with high school classes, and made any necessary changes before placing them in the hands of teachers, In only two cases did the returns from any of the schools indicate a variation from the directions, and the papers from these schools were rejected.

With the large number of schools so widely distributed it was impossible to prevent some variation in physical conditions, such as weather, noise, etc. However the teachers were asked to report any disturbing elements which might influence the results of the tests. From these reports it would seem that such variations were not serious.

Two scores were kept for each test. One was based on the number of necessary statements (or parts of figures in the case of Test A), given correctly, and the other was based on the number of incorrect and unnecessary statements given. The former will be referred to as the *positive* score, and the latter as the *negative* score. The author knows of no valid method of combining these two elements and certainly for the purpose of diagnosis it is desirable that they should not be combined. Weighted positive values have been assigned to the exercises of each test. These values were based upon the average per cent. of necessary statements given correctly for each exercise by all pupils taking the test, and they were so selected that a perfect score for a test would be one hundred. It did not seem possible to assign weighted negative values to the various exercises, as there was no upper limit to the number of errors that could be made, and there was, therefore, no basis for comparison. Hence the total number of unnecessary and incorrect statements in a paper was taken as the negative score.

In order to insure uniformity of scoring all papers were marked by the author. In each test the first exercise was scored for the entire school, then the second, and so on, until all the exercises had been marked for a given school. Where an exercise admitted of a variety of solutions, a copy of each solution found among the papers, together with a memorandum of how it was scored, was kept as a guide in all similar cases.

In order to detemine the relation beween the teachers' marks and the abilities in question, the coefficient of correlation between the school and test grades was computed. For this purpose it was impossible to combine the data from the various schools as they had different standards for grading. Hence the coefficient was computed separately for each school. In order to obtain this coefficient, it was necessary to array the pupils of a school according to the grades which they received for the first two books of geometry and again according to the test scores. The latter array of pupils had to be based on both the positive and negative scores. In order to meet this condition the pupils were arrayed according to the positive scores, and again according to the negative scores. The two ranks thus assigned to each pupil were added, and the pupils were again arrayed according to these sums. The formula :[2]

[2] See WILLIAM BROWN, *The Essentials of Mental Measurement*, pp. 42–53.

$$\rho = 1 - \frac{6 \Sigma d^2}{N (N^2 - 1)}$$

was then used to compute the coefficient and the result obtained by this formula was corrected by the formula

$$r = 2 \sin \left(\frac{\pi}{6} \rho \right)$$

TABLE I

Coefficients of Correlation for Test A.

School	r	P. E.	Relation of r to 3 P. E.
XXIII	0.313	0.068	r>3 P. E.
XXV	0.395	0.071	r>3 P. E.
XXXIII	0.111	0.180	r<3 P. E.
XXXV	0.628	0.089	r>3 P. E.
XXXVI	0.303	0.125	r<3 P. E.
XXXIX	0.426	0.140	r>3 P. E.
XL	0.487	0.079	r>3 P. E.
XLI	0.303	0.093	r>3 P. E.
XLII	0.697	0.051	r>3 P. E.
XLIII	0.436	0.088	r>3 P. E.
XLIV	0.364	0.085	r>3 P. E.
XLV	0.364	0.086	r>3 P. E.
L	0.588	0.123	r>3 P. E.
LI	0.240	0.188	r<3 P. E.
LII	0.528	0.074	r>3 P. E.
LIII	0.588	0.055	r>3 P. E.
LIV	0.150	0.147	r<3 P. E.
LVI	0.199	0.085	r<3 P. E.
LIX	0.688	0.069	r>3 P. E.
LX	0.578	0.087	r>3 P. E.
LXI	0.548	0.099	r>3 P. E.
LXII	0.436	0.053	r>3 P. E.
LXIII	0.292	0.069	r>3 P. E.

TABLE II

Coefficients of Correlation for Test B.

School	r	P. E.	Relation of r to 3 P. E.
XIV	0.467	0.127	r>3 P. E.
XV	0.548	0.127	r>3 P. E.
XVI	0.447	0.079	r>3 P. E.
XVII	0.140	0.115	r<3 P. E.
XVIII	0.188	0.056	r>3 P. E.
XIX	0.230	0.076	r>3 P. E.
XX	0.219	0.051	r>3 P. E.
XXI	0.323	0.075	r>3 P. E.
XXV	0.568	0.059	r>3 P. E.
XXX	0.395	0.081	r>3 P. E.
XXXI	0.271	0.090	r>3 P. E.
XLVII	0.668	0.065	r>3 P. E.
XLVIII	0.261	0.096	r<3 P. E.
XLIX	0.538	0.054	r>3 P. E.
LVII	0.588	0.075	r>3 P. E.
LVIII	0.344	0.086	r>3 P. E.

TABLE III

Coefficients of Correlation for Test C.

School	r	P. E.	Relation of r to 3 P. E.
VII	0.209	0.123	r<3 P. E.
VIII	0.548	0.030	r>3 P. E.
IX	0.178	0.080	r<3 P. E.
X	0.385	0.108	r>3 P. E.
XI	0.416	0.110	r>3 P. E.
XII	0.538	0.054	r>3 P. E.
XIII	0.333	0.090	r>3 P. E.
XXVIII	0.436	0.093	r>3 P. E.
XXXII	0.042	0.138	r<3 P. E.
XXXIV	0.487	0.058	r>3 P. E.
XXXVII	0.406	0.116	r>3 P. E.
XXXVIII	0.508	0.099	r>3 P. E.

TABLE IV

Coefficients of Correlation for Test D

School	r	P. E.	Relation of r to 3 P. E.
V	0.351	0.066	r>3 P. E.
XXII	0.528	0.077	r>3 P. E.
XXIII	0.209	0.078	r<3 P. E.
XXIV	0.325	0.077	r>3 P. E.
XXV	0.395	0.013	r>3 P. E.
XXVI	0.303	0.035	r>3 P. E.
XXVII	0.126	0.057	r<3 P. E.
XXIX	0.568	0.056	r>3 P. E.
XLVI	0.323	0.044	r>3 P. E.

The coefficients of correlation for each of the tests are given in Tables I–IV. If the coefficient is greater than three times the probable error it has scientific significance. In the majority of the schools, this is true, and we may conclude that usually the teachers' marks do bear a positive relation to the abilities with which the investigation is concerned. In considering these coefficients it is to be remembered that the school grades should depend upon factors not included in this investigation, and therefore the correlation should not be perfect. In several cases the coefficients are fully as high as can be expected. However they are frequently low and in many cases they are so low that, if they can be taken as indices of the value of abilities, then the schools are scarcely justified in giving as much time to this phase of geometry as they now do.

TABLE V

Summary of Positive Scores

Test	Medians for all Pupils tested	25-per-centile	75-per-centile	Lowest Median by any School	Highest Median by any School
A	62.5	51.3	72.9	50.5	78.7
B	69.3	51.8	82.2	38.5	80.9
C	50.6	36.5	65.2	29.0	67.0
D	73.3	55.4	87.0	54.7	80.5

TABLE VI

Summary of Negative Scores

Test	Medians for all Pupils tested	25-per-centile	75-per-centile	Lowest* Median by any School	Highest Median by any School
A	7.1	10.7	4.2	11.8	4.8
B	3.5	5.9	1.5	4.5	2.0
C	4.1	7.3	1.9	7.3	2.4
D	2.6	5.4	0.9	3.7	1.5

The median positive and negative scores made by all pupils taking each test are given in Table V and VI. Since we do not know that the tests measure the respective abilities in the same way, we can not compare the results of the different tests. Thus the low median score of Test C does not necessarily indicate that the pupils have less ability to recall facts about a figure than to do any of the things called for in the other tests. However, we may compare the results obtained by giving the same test in different schools. Such a comparison shows that some of the schools are developing these abilities much more effectively than others. In the case of each test the marks of some schools are quite satisfactory, while those of others are very low. This variation in achievement may be due, in part, to differences in local conditions, rather than differences in methods and in teaching ability. Nevertheless, it is difficult to see how local conditions could result in the extremely low scores made by some schools. If the abilities tested are essential to success in the study of geometry, then the results indicate that progress is almost impossible in some of the schools until these abilities have been further developed. On the other hand, the achievements of other schools indicate that it is altogether possible to develop these abilities to a fair degree during the study of the first two books of geometry.

*As the negative scores represent the numbers of incorrect and unnecessary statements, the larger numbers represent the lower scores.

Since, as we have seen, these abilities may be satisfactorily developed, but in many cases they are not, then if they are of value it is important that we have some means for determining when they are satisfactorily developed. It is believed that these tests or others similar to them will prove valuable for this purpose. The standards given in Tables V and VI furnish a means of comparison. If a class is above the median scores in these tables, and especially if it is near or above the 75-percentile marks, the teacher may be fairly sure that the abilities have been sufficiently developed to insure the success of the class. If, however, the class falls below the median score in any one of the tests, and especially if it falls near or below the 25-percentile mark, special effort should be made to develop the ability in question.

A STUDY OF A CLASS OF CHILDREN OF SUPERIOR INTELLIGENCE

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The idea of special classes for children with traits markedly different from the average child has been advocated by advanced thinkers in education for several years. Its first realization was in the organization of classes or schools particularly suited to deaf, dumb, and blind children. Later, notably in the first years of the twentieth century special classes for the feeble-minded were formed. During the last decade and especially during the last five years, attention has begun to turn to the children at the opposite end of the scale from the defective, and those children who show unusual ability are coming into the field of educational research and special pedagogical endeavor. Dr. Edward L. Thorndike, in an address in New York in 1914, stated that the United States government and numerous organizations of the state and city, to say nothing of private societies, were spending millions of dollars, doubtless justifiably, for the care of those who were low on the scale of mental ability, such as criminals, paupers, and defectives in mind and body, but that nothing was being done in state or nation in the way of special care for those who were unusually gifted. Dr. Thorndike stated further that, in his opinion the benefit which would accrue to the state in the effort to preserve and to develop to the extent of its ability its best product would far out-value that derived from the care of the less able. Since that time, students of mental development, especially those working in educational psychology, have shown a keen interest in the gifted child and his opportunities. Here and there special effort has been directed to the training of gifted individuals, but to the writer's knowledge, no work had been done in the public schools for the gifted child, comparable with the specialized effort made to train the feeble-minded, until within the last year.

In October, 1916, a class for exceptional children was organized under the control of the administration of the city schools of Louisville. For two years Louisville had had an accelerated class where children of the fourth grade, who in the judgment of teacher and principal were considered especially able, were allowed to complete in one-half year the work prescribed by the course of study for one year. It was found, on investigation, that these children differed

greatly in mental caliber. Some were over age; some normal; while others were under age. Not all were exceptionally capable.

In order to get a class, each member of which had unusual natural ability, it was decided that the organization must be made on the basis of scientific mental tests. Consequently, during the month of September sixty-two children were examined; fifteen were selected who had an intelligence quotient ranging from 120 to 145. It was thought that the number was too small for a separate room and teacher, so they were taught with the accelerated class until February. These children accomplished one year's work of the curriculum in a half year and were the leaders in the class room exercises. In February one hundred eleven more children were examined. Twenty-two were selected and the "Opportunity Class" at the Normal School was organized. This group consisted of ten boys and eleven girls. They ranged in age on entrance in February from 7.7 to 9.8 with an average age of 8.7 years. Almost all of them were just beginning the work of the 4B grade though three, numbers 1, 8 and 19, were entering 3A. The Terman Revision of the Binet-Simon Scale test supplemented by the Goddard form board was made the basis for entrance. Table 1 shows the result of the measurement in intelligence quotients.

TABLE I

No.	Boys	No.	Girls
1	159.1	11	136.6
2	145.4	12	141.6
3	134.0	13	135.2
4		14	145.6
5	142.3	15	161.9
6	137.3	16	120.5
7	159.4	17	122.3
8	155.1	18	137.4
9	167.9	19	135.8
10	138.0	20	123.4
		21	123.0

The range of ability is from 120 to 167.9 I. Q. with a median of 137.4, standard deviation of 13.9 and probable error 8.1. Dr. Terman finds standing of from 90 to 110 I. Q. to be normal, from 110 to 120 to be superior intelligence, from 120 to 130 very superior intelligence and from 130 on genius or near genius.

During March, April and May other tests that were given were the form board standardized by Dr. Goddard, the analogies test, by Dr. Whipple, the easy and hard direction test, the genius-species

TABLE II

	M	S. D.	P. E.
Analogies B			
Gifted Class			
March	18.9 Words	1.4	1.4
	M– 3.5 Sec	1.5	.7
	Av– 7.0 Sec		
May	20.0 Words	1.0	.0
	M– 2.7 Sec	1.0	.6
	Av– 4.2 Sec		
Analogies B			
Whipple. Selected Children	Av– 8.9 Sec		
Unselected "	Av–11.11 Sec		
Opposites			
Gifted Class			
IV	19.5 Words	1.1	1.4
	7.0 Sec	1.8	1.5
IV Op	20 Words	.07	.0
	6 Sec	1.4	.8
Opposites			
Normal (Norsworthy)			
9 years			
IV	9.5 Words	....	1.7
IV Op	9.0 Words	....	2.0
Genus Species	20 Words	2.3	0.0
Gifted Class	8. Sec	3.3	2.2
Genus Species			
9 years			
Pyle	10.8 Sec	2.9 A. D.	
Easy Directions	Perfect Reaction	....	....
Gifted Class	6.9 Sec	1.2	.9
Woodworth & Wells			
College Students	3.6	.92 A. D.	.28
Hard Directions			
Gifted Class	18.5 reactions	2.1	1.8
	10.6 sec.	2.4	2.0
Hard Directions			
Woodworth & Wells	5.4 sec.		
College Students			

Form Board Gifted Class	18.1	2.2	1.5
Form Board 9 years Goddard	18.2	....	....

M—Median. S. D.—Standard Deviation. P. E.—Probable Error.

test by Woodsworth and Wells, and the opposites tests used by Dr. Norsworthy. Table II shows the results in quantity of work and time, in comparison with available records for the average child. The children were told, except in the analogies test, to write as rapidly as possible the requirements of the test. The record is the median word accomplishment and the median of the average association time. The analogies test was given orally and the reaction time for each element was taken.

Table III shows the correlations of the above results by Pierson coefficient.

TABLE III

I. Q. and Opposites	.662
I. Q. and Analogies	.57
Analogies and Opposites	.75
Analogies and Genius–Species	.68
Analogies and Hard Directions	.43
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Analogies and Form Board	.20
Opposites and Genus-Species	.62
Opposites and Hard Directions	.36
Opposites and Easy Directions	.62
Opposites and Form Board	.38

These tests were chosen because of the varied abilities which they seemed to measure. The results show that children of mental acumen ranging above 120 can do work at least two or three years in advance of the average child, and can perform varied kinds of mental activity almost equally well. An exception must be made of the form board tests in which ideas function least and motor control enters quite extensively.

Besides the individual measurements, tests were also made with educational scales. The results with standard comparisons are given in Table IV.

The correlation of the educational tests with the intelligence quotients is given in Table V.

TABLE IV

	M	S. D.	P. E.
Reading (Thorndike) Gifted Class	6.6	.6	.25
Thorndike Standard			
4th Grade	5.25		
6th Grade	6.5		
Reading (Kelly) Gifted Class			
Test for grades 3, 4, 5	20.4	4	1.9
Test for grades 6, 7, 8	20.	6	3.0
Kelly Standard			
Test for grades 3, 4, 5	9.9		
Test for grades 6, 7, 8	13.4		
Language Trabue, gifted class Scale B	16.	2.0	1.0
Trabue Standard			
4th Grade	3.5		
6th Grade	4.5		
Spelling (Ayres) Gifted Class	25 Words 98%	1.0	.0
Ayres Standard			
4th Grade	88%		
6th Grade	98%		
Reasoning Problems (Starch) Gifted Class	7.7	1.3	1.5
Starch Standard			
4th Grade	6.2		
6th Grade	9.4		
Addition (Courtis) Gifted Class	7.0	2.0	2.2
Courtis Standard			
4th Grade	5.		
6th Grade	9.		
Addition Woody	14.	2.7	2.7
Woody Standard			
4th Grade	11.		
6th Grade	16.		

TABLE V

Thorndike Reading and Intelligence Quotient				.494
Kelly Reading	"	"	"	.39
Trabue Language	"	"	"	.509
Starch Reasoning in Arithmetic	"	"	"	.48
Woody-Addition	"	"	"	.14
Courtis Addition	"	"	"	.09

Judging from the results of the educational tests, children of 120 I. Q. and above can do school work at least two or three years in advance of the average child and can master the different studies of the curriculum almost equally well. Reading and language contests stand at the head of the list and mathematical work as it is found in addition and reasoning problems the lowest. This latter seems to be due to the more extensive exercise of the former function and to lack of practical training in the latter.

Table VI shows the physical measurements of the children under consideration in height and weight. These measurements were taken in March. They are not accurate, since the children were not stripped, but they were given a fair estimate of physical condition and show that the members of this class exceed the average child in height and weight.

TABLE VI

Boys	Chro age	Weight Kg	Normal Wt. Kg	Height Cm	Normal Ht Cm
1	...	.....	.....	.....	.....
2	8.5	28.1	25.06	134	123.48
3	8	27.2	23.81	129	120.93
4	8.5	22.0	25.06	123	123.48
5	...	....	.....	.....	.....
6	8.5	34.4	25.06	141	123.48
7	8.5	28.8	25.06	133	123.48
8	...	....	.....	.....	.....
9	8.5	23.6	25.06	121	123.48
10	8	27.6	23.81	124	120.93
Girls					
11	9.5	38.7	26.52	143	127.74
12	...	....	.....	.....	.....
13	8.5	22.0	24.22	129	122.75

14	8	21.1	23.01	120.5	120.49
15	9	27.4	25.25	131.5	125.24
16	8.5	22.9	24.22	127	122.75
17	8.5	23.8	24.22	125	122.75
18	9	31.0	25.25	128.5	125.24
19	8.5	26.1	24.22	134.5	122.75
20	9	20.2	25.25	123	125.24
21	8.5	25.2	24.22	149	122.75
Average	8.5	26.5	24.66	130.3	123.35

In character and disposition these children are conceded by all who have worked with them to be superior. They are not conceited or puffed up by their selection or work in the class. However, improvement in this respect has been marked. The teacher was asked to take note of morale in order to ascertain if possible the value, in terms of character development, of the gifted class segregation—a child's opportunity to work with his peers. The notes are given below without editing.[1]

"I have noticed changes in the dispositions of many of the children. The following are most worthy of note.

"A constantly spoke in a surly, critical tone and did not enter into the activities of the class with apparent interest. He seemed to be somewhat on the defensive. Now he shows a co-operative spirit and we have not heard that surly, complaining tone for two months or more.

"B was exceedingly nervous and so self conscious that she stammered when called upon to recite. She is much less nervous, and speaks with assurance and self possession.

"C has always been lovable and thoughtful of others but at first, because of excessive interest he was inclined to insist upon dominating the situation during discussion. Now, he considers the rights of others and is satisfied to listen to the contributions of other pupils and to await his turn.

"D was conceited, overbearing, and hypercritical. He now shows co-operative spirit and is not at all critical."

The school work of the Opportunity Class represents in value, according to the Louisville course of study, the performance of the entire fourth year. Besides the accomplishment of this work the children learned to use with a considerable degree of freedom four hundred words in conversational German. They also composed the poem and music of a spring song and an operetta.

The class did this work happily and with ease. Home study was discouraged except where it was a matter of great desire and then it was limited to twenty minutes.

The school room was made as attractive and homelike as possible. It was seated with chairs so as to allow freedom of movement and furnished with library tables for reading. Plants and flowers filled the banked windows. The whole atmosphere of the room was that of happy, joyous work-a-day freedom.

The method of teaching employed might be termed the method of vital experience. Abstract ideas were, in no sense of the word, the stock in trade but the needs of the group in the normal life activities, real situations in the social milieu were made the foundation of the learning process.

It would be unfair to close this paper without some tribute to Miss Jessie Marshall, the young woman who served as teacher of the class and whose life closed with the school year. Her work with the class was truly a masterpiece of teaching art. She "lived with the children" in the best sense of that ideal; giving them the privilege of growth by their own experience and making the way of progress delightful and exceedingly profitable.

Conclusions: From the results of the different tests and the experiences of the year it seems justifiable to conclude:

First, that gifted children are able to accomplish, with ease, the ordinary two year's school work in one year.

Second, that they are apt to be unusually able in various fields of human learning.

Third, that they are especially capable of handling ideas and that their thinking is marked with quickness and directness.

Fourth, that gifted children in common with those of less mental calibre can and do form bad habits thereby crippling their ability. This was especially shown in the studies in arithmetic and social attitude.

Fifth, they are highly social in the scientific sense of the term. They tend to have good dispositions and lend themselves generously to the needs of the group.

Sixth, their lives should be normal and natural. Abstract ideas should not be their stock in trade but living vital experiences. They should be allowed to think for themselves.

Seventh, in order that they may contribute most acceptably, gifted children should have special opportunities to work in co-operation with the social group.

COMMUNICATIONS AND DISCUSSIONS

AN APPARATUS FOR THE MIRROR-DRAWING TEST

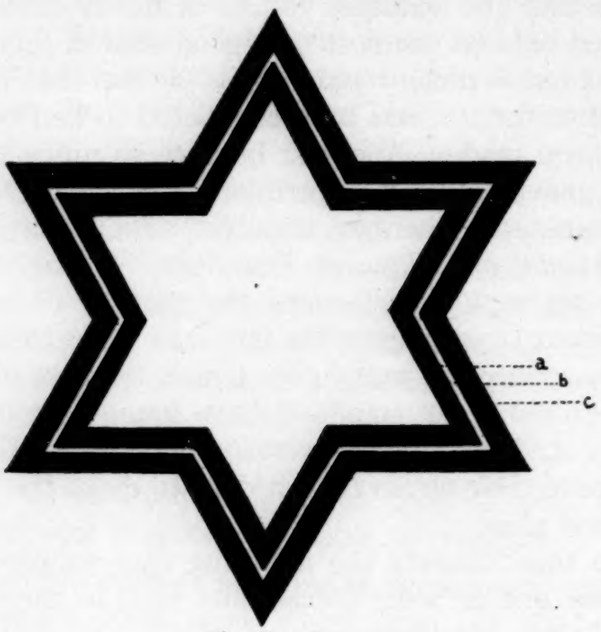
The interesting and valuable results of mirror-drawing tests are often obtained only at the cost of a good deal of labor. The usefulness of this test is much restricted by the fact that so much work is required after the test has been completed to find out how many errors have been made. And just because so much labor of computation is unavoidable in experimental psychology it is worth while to eliminate it wherever possible. The figure in Whipple's *Manual of Mental and Physical Tests*, test 36, page 493, is quite typical. An attempt to determine the number of errors in that figure is sufficient to emphasize the fact that when these errors have to be actually counted on many such figures the expenditure of time and effort required is not small. I have found that it takes really more time for students who are working upon mirror-drawing problems to compute their errors than it does to make the mirror-drawings in the first place.

To obviate this difficulty the following very simple arrangement has been made and is being successfully used in the psychological laboratory of Ohio Wesleyan University.

Two concentric stars of metal are made and so arranged that the outside line of the smaller shall be smaller than the inside line of the larger. Thus when they are arranged concentrically the space between them is itself star shaped. If this space be filled up with some plastic substance which becomes very hard and which differs in color from the metal a clear cut and permanent star will be formed. The metal strips are electrically connected with each other and to an electric counter, arranged in series with some power source, and with a stylus having a sharp metal point. Add the familiar mirror and screen.

The test is performed in exactly the same way as if the printed star outline and pencil were used. The student tested simply attempts to keep the stylus upon the inscribed figure. Any and every time the stylus moves from the inscribed star the counter registers. And at the conclusion of the test it is as easy to determine the number of errors as it is to determine the elapsed time. In each case one simply reads a dial.

A point of importance is that by means of the apparatus a somewhat simple definition of an error is made. An error consists of enough lateral movement of the stylus to move it off of the inscribed star. Thus an error means exactly the same thing to all students, and its definition will not vary from day to day.



a and c are the brass stars, five millimetres in width. b is of non-conducting material, one and a half millimetres in width. a and c are electrically connected to a binding post set in the upright (not shown) at the left rear corner of the cement base.

The apparatus as used in the psychological laboratory of Ohio Wesleyan University consists of a cement base in which are embedded two brass stars, arranged concentrically as described above. The resulting inscribed star measures ten centimetres from point to point, and is one and a half millimetres in width. It is needless to say that the cement is very carefully smoothed so that its surface is exactly level with that of the brass stars. The strips of which the brass stars are made are five millimetres in width. At the back and left of the cement base a metal post is inserted for the support of a mirror which is so pivoted that it can be tilted and fastened at any angle from the perpendicular. From this upright an arm projects to support the small metal screen which intervenes between the eyes

and hand of the one taking the test. The electric connections from the brass stars run under the base to the mirror upright, and a binding post in the upright serves to connect the stars with the batteries.

Obviously the form of figure used may be varied as desired. It is also possible that in later types some more suitable material than cement may be found for the base.

The handiness of this little apparatus may enlarge the usefulness of the test. It has already been suggested that the test is capable of being employed as a test of quickness in learning. If so used this form of apparatus will reduce the amount of work and the time required for performing the test very considerably.

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PERCENTILE NORMS FOR SCALING DATA

Scales devised upon a basis of percentile differences are bound to be very crude, besides embodying a fundamental fallacy. Measurements of a group may be resolved into quartile, quintile, decile or percentile intervals. A subject measured for a given quality may conveniently be compared with his group to determine his location within the group. Or two individuals measured for the same trait may be compared for relative differences in the light of the percentile grades of the group. We cannot, however, equate, translate, or combine the raw percentile values in various tests, because the significance, for example, of the 80th percentile may vary greatly when we consider the variability and dispersion of the different traits.

But what is perhaps of more fundamental importance is that for testing purposes the unrefined measurements obtained for a test should be first transformed into P. E. (probable error) values, or into sigma (standard deviation) values. These only can give us absolute units necessary in scaled data. Excellent examples of this type of procedure are the studies of Buckingham, Trabue and Woody. In experimental analyses of this sort one is certain that the difference between points 5 and 6 on our scale is equal to the difference between 0 and 1, or 14 and 15, or any other two adjacent units. This, however, is not true for units in a percentile scale. The difference between the 0 and the 10th percentiles is not equal to the difference between the 50th and 60th or between the 70th or

80th percentiles. This fact will be obvious to anyone from a mere cursory examination of the ogive. Consequently the estimate of an individual's ability based on percentile differences in various tests which are finally averaged must not only yield but a very crude measure of intelligence development but is also to an extent misleading. This is emphatically true where an arbitrary score is assigned to various performances differing in the amount of error.

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ABSTRACTS AND REVIEWS

AUGUSTA F. BRONNER, PH.D. *The Psychology of Special Abilities and Disabilities.* Boston: Little, Brown and Company, 1917. Pp. VI, 269. $1.75

The rapidly growing structure of differential psychology which is developing about the corner-stone of individual differences has received a somewhat distinctive and valuable addition at the hands of Dr. Bronner. Too little attention, as this new work emphasizes, has been devoted to specialized powers and defects as distinct from general proficiency and general deficiency of intelligence. To the recognition of variability in individuals within the group must be added the recognition of variability in the relation to traits within the individual. Dr. Bronner with this end in view proposes to discuss examples with their significance, both of (a) particular disabilities in those who have normal general ability and of (b) particular abilities in those who have less than normal general ability, together with methods of attacking both these groups of cases.

The major emphasis of the study is throughout upon individual case examinations to which, in fact, two-thirds of the pages are devotvoted. Methods of examining the individual cases and precautions to be observed in the interpretation of results of these examinations are set forth in two chapters on diagnosis. An intimate and comprehensive study of each individual by means of a wide range of tests is to be supplemented by careful interpretation of the test records in the light of disturbing factors and in conjunction with an analysis of heredity, developmental history, and environmental conditions. The mere administration of any "intelligence scale" is never suf-

ficient for trustworthy diagnosis: for a pronouncement of feeblemindedness, the Binet results must be borne out by results with performance tests, by reactions to common sense situations, and by the extent of profiting from educational opportunities. In an interesting chapter on present educational tendencies attention is again called to the necessity for intimate study of individual cases as the prime need in analysing school and vocational failures and maladjustments.

The remainder of the book considers many rather detailed reports of examinations, grouped into types illustrative of specific defects and abilities, and sets forth suggestive ideas upon the practical social aspects of the cases. Such defects are treated as those which occur in number work, language ability, separate mental processes affecting all work (as memory, manipulation of concrete material, general slowness of reactions, higher processes), and defects in mental control. Instances of special abilities are reported occurring with general subnormality in fields of mental operation closely analagous to those in which these defects occur. In order to discover these special abilities and disabilities it is necessary, of course, first to possess a thorough analysis of the mental processes involved in the field where the defect occurs and then, second, to test for each such processes by rather specific tests. This is the plan of attack which Dr. Bronner approximates in each type of defect considered. All the forty-six cases given as examples in the text are succinctly summarized in an appendix of "Records of Psychological Examinations."

The conclusion of the entire study echoes the introduction in its emphasis upon the necessity for comprehensive diagnosis of the individual. As may well have been inferred from the nature of the treatment throughout, Dr. Bronner does not indulge in any glittering generalizations as a conclusion of her work. Perhaps in this respect the book does not quite satisfy the high hopes raised by the preface, but at least the abundance of factual material is a welcome substitution for fine theories and empty generalizations.

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The Journal of Educational Psychology

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EDITORIAL

SCHOOL POLICIES IN NEW YORK CITY

The recent change of administration in New York City carried with it a very considerable reorganization of the school system. One of the chief issues of the campaign was the retention or the rejection of the so-called Gary plan. The overwhelming character of the vote gave the new administration a mandate to eliminate the Gary plan root and branch, and to undo all the work done in that direction in the past six years. This is not easy, and it is to be hoped that some of the good features of that scheme may be retained or brought back into the system under another name.

One of the first tasks confronting the new mayor was the appointment of a school board of seven members to take the place of the old board of forty-six members. The selection of the personnel of this board was obviously a matter of some moment, since upon it would rest the responsibility for the administration's educational

policy, and upon the success of its measures would depend the public approval or disapproval of the change from the large to the small board. Of the mayor's appointees only two had ever been on the school board before, and only one, Mr. Arthur S. Somers, subsequently chosen president of the board, had seen continuous service in recent years. Thus most of the members were new to the educational public of the city, and their attitude was a matter of no little speculation. Within a few weeks Superintendent Maxwell, who has served the city faithfully for more than a quarter of a century, and who is now in poor health, was made superintendent emeritus under generous conditions, and the board began its search for a new superintendent. The selection of the proper man for this position increases the burden of responsibility upon the new board and is fraught with momentous consequences for the schools of the city.

In view of these facts the inaugural address of President Somers, who by his experience and his position has a preponderating influence in shaping the policies of the board, is a noteworthy document. The old board in spite of its large membership was always overwhelmed with a mountain of work, and was thereby greatly delayed in the transaction of business. Many of those in close touch with the New York schools contended that a board of seven members was entirely too small, and could never do the work that necessarily devolved upon the board of education in such a large city. On this point President Somers takes a wise and statesmanlike position: "A board of education of seven members cannot undertake, in the same manner, to do the work that a board of forty-six members did. The mass of unimportant matters and detail that came before the preceding board, because a system of standing committees encouraged it, we shall not set out to consider. We shall be a policy-making body. We shall not undertake to run the schools, but we shall make it our duty to see that they are run properly. To do this effectively we must abandon standing committees. They encourage the reference to the members of too many matters of routine. They lead department heads to seek committee approval before proceeding to action and thereby make for divided responsibility. If seven members are to undertake to render the largest possible service to the city schools, they must leave to the paid officers all matters too detailed for the consideration of all the members meeting together. They must work through a committee of the whole, rather than through standing committees, but

when occasion demands, or a particular problem is to be solved, it may be necessary to call upon a smaller number, as a special committee, to study the proposals. This board of education must, as I see it, determine policies, leaving to department heads the duty of carrying them out. We must hold our paid officials, all of them, to a strict accountability for results, and we shall not undertake to do other than give them the largest measure of freedom." This is in accord with the most approved findings in educational administration, and augurs well for the New York schools.

But not only are the members of the professional staff promised freedom from interference by board members in administering the work of the schools, but they are urged to free themselves from the burden of petty detail, in order that they may more intelligently study the problems that confront them. "As this board of education will not undertake to do what the large board that preceded it tried to do, but will consider problems and policies and not details, just so our board of superintendents and our district superintendents, our board of examiners and our directors, would do well to study ways to rid themselves of the burden of considering petty matters and numerous details. It has occurred to me to suggest for the consideration of the superintendent of schools and the board of superintendents that the members of that board be assigned to particular problems rather than to certain parcelled out branches of the service. When a superintendent is assigned to a committee on elementary schools or to a committee on high schools he gradually becomes submerged in a mass of routine and detail that hampers his vision of bigger problems. Similarly, our district superintendents have become too much examiners of details of organization and too little leaders in the solution of great school problems. The tendency is to become more expert in rating teachers and classes than in improving the teaching of children. The former, to my mind, is a relic of antiquity that should be among the first customs to be discarded. I believe that much time is spent in examining and rating teachers who are fully qualified. If that be so, why should not the principal's rating be sufficient? In any case where there is a doubt or where injustice is claimed, appeal may then be made to the superintendent, but only in such cases. Far more important is it that they concern themselves with the contents of children's heads than of teachers' desks and plan books. All this is a big problem for the board of superintendents and the district superintendents to study,

and I earnestly invite such study. Possibly it would be well to test a reorganization under which district superintendents would be assigned not to districts of varying size and unequal register, but to associate superintendents directed to study particular school problems."

Let us hope that this will mean the beginning of an era of the scientific study of educational problems such as New York has never seen. The problems lie in abundance on every hand, and there are many men on the supervisory staff well able to conduct such scientific studies. What is needed is a consistent and rational policy that will encourage such studies, and will demand them as part of the routine of supervision. The recent action of the board of superintendents and the board of education in authorizing the publication of 30,000 copies of the new New York penmanship scale, so that a copy may be posted in every school-room, is a step in the right direction. But let us also have studies of oral and silent reading, fundamental operations and reasoning in arithmetic, of spelling, of geography, of history, of literature, of elementary science. Let us actually determine the things that groups of children are able to do under definite school conditions; let us grapple with the problems of the bright child and the dull child and modify our school work to meet individual needs; let us ascertain to what extent school brightness and dullness are general traits and to what extent they depend upon specific characteristics; let us, in fine, demand that our educational procedure be based upon ascertained fact rather than upon traditional belief and vague opinion. J. C. B.

NOTES AND NEWS

An interesting development in educational scales and measurements is promised in the forthcoming New York City Scale of Penmanship, which is being devised by Clyde C. Lister and Garry C. Myers of the Brooklyn Training School for Teachers. Out of several thousand samples of penmanship collected from New York City school children, three hundred were selected as providing an even range from the best to the poorest. These three hundred samples were then sorted by each of twenty-five competent judges (most of them teachers of penmanship) into eight piles, the intervals between each grade being made as nearly equal as possible. This sorting was done three different times, first from the point of view of the form of the letters, second from the point of view of the spacing of the letters and words, and third from the point of view of the movement involved in the writing. Elaborate directions were given for judging the samples from each point of view, and after each sorting the samples were recombined in chance order. In the final arrangement there will thus be three scales, one for form, one for spacing, and one for movement. Each will consist of eight specimens, so selected on the basis of statistical treatment of the judgments as to constitute equal steps in a scale of increasing excellence. A detailed account of the construction of the scale will appear in an early number of THIS JOURNAL. The scale has been approved by the New York City Board of Education, and the printing of thirty thousand copies of it has been authorized.

An important question in educational psychology is raised in the following inquiry from a correspondent. "What would be the advisability of placing permanently upon the blackboard before children of the third to the eighth grade such sentences as the following: "I saw, not I seen;" "I did, not I done;" "He and I, not him and I;" and so on? Would this be a good method of correcting poor English? What would be the effect of the constant presence of the correct form, of the incorrect form, or of both together upon (1) the child who habitually uses the incorrect form, and upon (2) the child who rarely or never uses incorrect forms?" This sets a neat task for an educational experiment. Perhaps the chief difficulty in control would be the degree to which the teacher brings the forms to the focal attention of the pupils. If the forms were merely written on the blackboard and allowed to remain there without attention being called to them, they might have no more effect than the pictures on the walls or other articles of school furniture. This, however, might be controlled by systematic attention to the forms at stated

intervals. The question is a significant one, and the JOURNAL will be glad to receive for publication any experimental data bearing on it.

Public School 166, New York City, Miss Margaret Shaw, principal, reports an "Opportunity School" where children are given a chance to develop according to their abilities. The regular school curriculum is followed, but the school hours are from 8:30 until 4, and each pupil receives at least 100 minutes per week of special coaching in a "rapid advance" coaching class. The work of the school is supplemented by that of the Children's House, which is also under the direction of Miss Shaw. The average attendance is about 350, and last year 106 pupils graduated from the school, all of whom had done six terms' work in four terms or less.

The War Department has asked the land grant and technical colleges of the country to undertake the instruction during the summer of students from the military and training camps.—*School and Society.*

A Committee on Education and Special Training has been created by the War Department to study the needs of the various branches of the service for skilled men and technicians; to determine how such needs shall be met, whether by selective draft, special training in educational institutions, or otherwise; to secure the cooperation of the educational institutions of the country; and to administer such plan of special training in schools and colleges as may be adopted. The committee consists of Colonel Hugh S. Johnson, deputy provost marshal general; Lieutenant Colonel Robert I. Rees, of the General Staff; and Major Grenville Clark, of the Adjutant General's Department. The committee will be assisted by the following civilians: Charles R. Mann, Massachusetts Institute of Technology, James R. Angell, University of Chicago, J. W. Dietz, Western Electric Company, president of the National Association of Corporation Schools, James P. Monroe, member of the Federal Board for Vocational Education, and Samuel P. Capen, United States Bureau of Education, specialist in higher education.—*Science.*

At a recent meeting of the University of Michigan board of regents Professor Whitney reported an increase in enrolment in the department of education and a decrease in the teaching force, and requested the appointment of a professor of educational psychology and experimental education.

At the recent meeting of the Education Association of Western Pennsylvania Professor G. D. Strayer, of Columbia University,

spoke on "The Place of Scientific Measurement in Education," and Professor C. H. Judd, of the University of Chicago, on "Non-promotion." The subject of "Measurements" was the topic of discussion at fourteen separate section meetings.

The University of Rochester has expanded its work in psychology. Quarters are now provided for an experimental laboratory, and are thoroughly equipped for experimental purposes. Two experimental courses are given during the present year. One course, extending through the college year, emphasizes the psychology of the sense organs and more complex mental processes. The second course takes up the study of comparative psychology. Quarters for animal experimentation have been provided. The course is under the charge of L. A. Pechstein, Ph.D. (Chicago).

Dr. J. E. Wallace Wallin, director of the Psycho-Educational Clinic and Special Schools in St. Louis, will offer courses in Clinical Child Study and Subnormal Children in the summer session of the University of California in Los Angeles.

Professor Frank M. Leavitt, of the University of Chicago, has been appointed one of four associate superintendents and director of industrial training in the schools of Pittsburgh. He will also teach in the Carnegie Institute of Technology.—*School and Society.*

Dr. C. Judson Herrick, professor of neurology in the University of Chicago, has recently been commissioned major in the sanitary corps of the National Army.

Dr. R. H. Sylvester, assistant professor of psychology, University of Iowa, has joined the psychological division of the medical officers' training camp, Fort Oglethorpe, Ga.

Assistant professor Ambrose L. Suhrie, University of Pennsylvania, has been appointed head of the school of education, Western Reserve University, Cleveland, Ohio.

Dr. Francis N. Maxfield, assistant professor of psychology and assistant director of the psychological clinic, University of Pennsylvania, has been appointed psychologist in the public school clinic of Newark, N. J.

At the Madison, South Dakota, State Normal School Professor W. J. Bell has been appointed assistant director of the training school and chairman of the bureau of tests and measurements.—*School and Society.*

PUBLICATIONS RECEIVED

CHARLES ALTSCHUL. *The American Revolution in our School Textbooks.* New York: George H. Doran Company, 1917. Pp. 168. $1.00.

The war is changing our ideas about many things. It is making us more critical about the ultimate consequences of our educational procedure. The old isolation of America from the rest of the world, so urgently preached by Washington, is gone forever, and now we are beginning to realize that through the emphasis of half truths in our school histories we have deliberately built up a prejudice against some of our best friends. It is the service of the present study to bring this fact out clearly and definitely, and to show the need for a broader and juster treatment of the American Revolution. The author has made a careful study of ninety-three school histories published between 1880 and 1916, and has divided them into five classes on the basis of the fullness and fairness with which they present the conditions of thought in England and America prior to and during the Revolution. The book is made up largely of quotations from these texts and comments thereon. One soon becomes aware of the distorted and norrowly chauvinistic view which is inculcated by such texts, and appreciates the author's demand for a treatment which will bring out the fact that there was a parallel struggle between liberal and reactionary ideas in England itself, and that the American uprising was but a phase of the general movement toward democracy which later overturned France and England, too. The book should be in the hands of every teacher of American history.

WALTER S. ATHEARN. *Religious Education and American Democracy. The Correlation of Church Schools and Public Schools. A Community System of Religious Education.* The Malden Leaflets, Numbers 1–3. Boston: The Pilgrim Press, 1917. Number 1, Pp. 27. Fifteen cents. Number 2, Pp. 59. Thirty-five cents. Number 3, Pp. 45. Twenty-five cents.

These leaflets by the professor of religious education in Boston University were issued as a study course for the guidance of the Malden City Council of Religious Education. They represent an attempt to put religious instruction upon the same systematic basis as secular instruction in the public schools. Leaflet Number 2 is especially interesting in that it brings together in brief compass accounts of the various undertakings to develop systematic religious education in all parts of the country.

HENRY EASTMAN BENNETT. *School Efficiency, A Manual of Modern School Management.* Boston: Ginn and Company, 1917. Pp. x, 374. $1.25.

There will always be a demand for a general, introductory treatise on school management. In the present book the author touches lightly on such topics as school grounds, buildings, lighting, heating, ventilation, seats and desks, apparatus, health inspection, school organization, course of study, promotions, marking systems, reports, home study, routine, lesson plans, motivation of work, correcting papers, punishments, constructive and corrective school government, the school and the community, and the rights, duties, and aims of the teacher. While the discussion of each of these themes is necessarily brief, the author is to be commended for bringing his treatment up to date and for referring to books that have been issued within the last few years. The book will be of value to those who desire a casual view of the entire field of school activities, and who do not care to go very deeply into any particular subject.

RANDOLPH BOURNE. *Education and Living.* New York: The Century Company, 1917. Pp. x, 236. $1.25.

This is a collection of papers reprinted from *The New Republic* in which the author attempts to give glimpses of new tendencies in American schools. The author says "The public school is the most interesting and the most fruitful of our American enterprises . . . . . The school fascinates me because there is almost no sociological, administrative, or psychological truth that cannot be drawn out of its manifold life. It is the laboratory for human nature, and the only one that is simple enough to study with any prospect of quick enlightenment. Experiment in education has come to stay, and this means that we have it in our hands to approach ever more closely our ideal of education as living." By experiment, however, we must not think that the author has anything so definite in mind as mental or educational tests. He means rather such undertakings as the Gary Plan, the Fairhope Summer School, the Ettinger Plan, continuation schools, and the various school surveys. As an easy popular expression of new tendencies in education, the book will serve an excellent purpose.

GAMALIEL BRADFORD. *A Naturalist of Souls.* New York: Dodd, Mead and Company, 1917. Pp. 292. $2.50.

This is an interesting venture in psychography. Not the psychography of William Stern and the scientific psychologists, but psychography in the sense of Saintsbury, Sainte-Beuve, and other interpreters of literature. In the first chapter the author explains what he understands by psychography. A portrait presents only a single phase of its subject, while the psychograph seeks "out of the perpetual flux of actions and circumstances that constitute a man's

whole life to extract what is essential, what is permanent and so vitally characteristic." It differs from biography in that biography is bound to present an elaborate sequence of dates, events and circumstances to make the narrative complete, while the psychograph selects only that which is vital to the individual subject. Psychography differs from psychology in that "the latter does not deal primarily with individuals but with general principles." Among the authors visited in these diverting excursions are the poet Donne, the Italian pessimist poet Leopardi, Anthony Trollope, Richard Burton, author of *The Anatomy of Melancholy*, Alexander Dumas, the Earl of Clarendon, the younger Pliny, Francis of Sales, and the novelists of the late Greek period. The essays are delightful reading, simple, direct and unaffected, investing these well-nigh forgotten authors with a charming reality.

F. S. BREED AND E. F. DOWN. *Measuring and Standardizing Handwriting in a School System.* Reprinted from the Elementary School Journal, Volume 17, Number 7. March, 1917. 470-484.

The authors contend that each school system should measure its present achievement in handwriting, should establish norms of achievement, and should construct its own scales for measuring achievement. The present article deals with the construction of such a scale on the basis of specimens of handwriting from grades III–VI of the Highland Park, Michigan, schools.

ERNEST R. BRESLICH. *Third Year Mathematics for Secondary Schools.* Chicago: The University of Chicago Press, 1917. Pp. xviii, 369. $1.00.

ERNEST R. BRESLICH. *Logarithmic and Trigonometric Tables and Mathematical Formulas.* Chicago: The University of Chicago Press, 1917. Pp. xviii, 118. Seventy-five cents.

This book with the accompanying tables furnishes the third unit in the author's series of texts in secondary mathematics. It continues the plan, so ably set forth in the previous volumes, of carrying all phases of secondary mathematics side by side, instead of devoting a certain time to algebra, another period to plane geometry, a third to solid geometry, and a fourth to trigonometry. To show the scope of the treatment, the first chapter presents the elements of functions of one unknown with graphic representations, chapter two deals with trigonometric functions, chapter three with linear equations in their development and philosophical significance. Subsequent chapters treat quadratic equations in one and two unknowns, factoring, exponents and radicals, logarithms and the use of the slide rule, the solution of triangles, relations between functions of several angles, the binomial theorem, areas of surfaces, computation of volumes, and polyhedral angles. The plan commends itself strongly as well-balanced and carefully worked out. From a general point of view it has two marked advantages. It makes it possible

to give all pupils a fairly broad view of the whole subject of mathematics, and then allow them to drop the study if they are not mathematically inclined. For the pupils who go on in the subject it organizes and binds together the various parts in such a way as to make more likely their subsequent functioning in any practical activity demanding mathematical skill.

SARA CONE BRYANT. *Stories to Tell the Littlest Ones.* Boston: Houghton, Mifflin Company, 1916. Pp. xiv, 178.

Nothing appeals to children like a story and in this volume are to be found many happy efforts of a veteran story-teller. The book will be a boon to mothers and teachers.

C. MACFIE CAMPBELL. *The Sub-normal Child—A Study of the Children in a Baltimore School District.* Reprinted from Mental Hygiene, Volume 1, Number 1, January, 1917. 96–147.

An intensive study of the Locust Point District in Baltimore, comprising over 1500 children of school age. The sub-normal children have been studied in detail and tables are given showing chronological age, mental age (Binet-Simon), pedagogical age (grade), heredity and other data which throw light on the case.

FRANK G. CARPENTER. *Around the World with the Children.* Cincinnati: American Book Company, 1917. Pp. ix, 133.

This is an entertaining and magnificently illustrated introductory book to geography. It will acquaint the children with the peoples of distant lands, their customs, mode of life, and occupations, particularly children's occupations.

WILLIAM ESTABROOK CHANCELLOR. *A Theory of Motives, Ideals and Values in Education.* Boston: Houghton Mifflin Company, 1917. Pp. xiii, 534.

This is a reprint of a book first published ten years ago, and rather well known in the educational world. There is no evidence of any revision. The author discusses in an entertaining way all sorts of educational topics, and manifests withal such a wealth of literary allusion and citation, such a depth of sociological and philosophical erudition that he cannot fail to make an impression upon the reader. There is much good advice (perhaps the carping critic might charge the author with inordinate preaching), and there are many passages that stimulate to reflection, perhaps to opposition. Certainly a perusal of the book will result in no little gain to the reader.

BERTHA M. CLARK. *Laboratory Manual for Introduction to Science.* Cincinnati: The American Book Company, 1917. Pp. 203.

This loose-leafed laboratory note book is to accompany the author's text on Introduction to General Science and gives detailed directions for a large number of simple and practical experiments.

GEORGE ALBERT COE. *A Social Theory of Religious Education.* New York: Charles Scribner's Sons, 1917. Pp. xiii, 361. $1.50.

"The future of society depends upon the sort of social education that we think it worth while to provide. All the plans and methods of religious education have now to be recognized with reference to social relations and experiences. A new measure is provided for the material that goes into the curriculum of instruction. The educational relations between church and state have a different look when we approach them from the standpoint of a thoroughly socialized religion. Not less true is it that emphasis now shifts from one part of educational psychology to another." A careful examination of the Bible from the politico-social point of view shows that its entire scheme is autocratic. But at the present time we are fighting autocracy with all our might. Can a democratic religion be worked out on a Biblical basis? The author believes that it can, and tries to show how it is to be done. The book should be carefully considered, especially by those who have their doubts about the social outcome of any form of religious education.

H. E. CONARD AND G. F. ARPS. *An Experimental Study of Economical Learning.* Reprinted from the American Journal of Psychology, Volume 27, October, 1916. 507–529.

The problem of this experiment was to determine the loss in speed and accuracy accompanying the traditional methods of teaching the four fundamental operations in arithmetic as compared with more economical methods. On the basis of scores in Courtis Arithmetic Tests, series B, 64 first year high school pupils were divided into two equal groups, one of which was trained by traditional methods, the other for an equal length of time by the improved method. The Courtis Tests were then given a second time in order to determine the exact amount of superiority attained by the economical method. Elaborate tables and graphs of the results are shown, and a superiority of approximately 33 per cent. is claimed for the economic method.

KATHERINE M. COOK AND A. C. MONAHAN. *Rural School Supervision.* Bulletin 1916, Number 48. Washington, Bureau of Education, 1917. Pp. 63. Ten cents.

The monograph presents a sketch of the origin and development of school supervision, both state and local, recounts the present status of rural supervision, and describes special forms of rural supervision in various parts of the country.

CHARLES WILLIAM DABNEY, Chairman. *A Study of Educational Conditions in Mexico, and an Appeal for an Independent College.* Cincinnati: Committee for the Study of Educational Conditions in Mexico, 1916. Pp. 93.

This is a report on educational conditions in Mexico by a committee of prominent educators in this country. The author of most of the report is Professor George B. Winton, now of Vanderbilt University, for thirty years a teacher in Mexico. The report is an excellent history of Mexican education, a survey of the present situation, and proposals for betterment.

CHARLES A. ELLWOOD. *An Introduction to Social Psychology.* New York: D. Appleton and Company, 1917. Pp. xiii, 343. $2.00.

In this book the author endeavors to bring to bear upon the problems of society the methods and results of modern psychology. He believes that the explanation of social phenomena is to be sought in the underlying traits and dispositions of the individual, in the influences of the environment which act upon his plastic nature, and in the resultant aims and standards which he develops. The first three chapters lay the foundation for the discussion in the development of the biological point of view, and in an outline presentation of the salient features of human and comparative psychology. The body of the work deals with the nature of social unity, social continuity, and social change under normal and abnormal conditions. Then follow applications of social continuity and change in such phenomena as instinct, imitation, sympathy, and social progress. The book is sane, reasonable, and carefully thought out, and is much freer from the vagaries of faculty psychology (such as the atomistic conception of instinct as an all-explanatory agency) than most recent works on social behavior.

HERMAN FERNAU. *The Coming Democracy.* New York: E. P. Dutton and Company, 1917. Pp. viii, 321. $2.00.

There are some Germans whose thought has advanced beyond the stage of medieval feudalism,—but they dare not live in Germany. The author of this book lives in Switzerland, and those who have read or heard of his earlier work, "*Because I am a German,*" know that it would not be safe for him to show himself in Germany at present. This book is a strong appeal to the German people to rid themselves of their fetishistic adoration of autocracy, and to assert their right to govern themselves. The first chapter gives a very careful survey of the causes of the war, showing conclusively that hostilities were deliberately brought on by the German war party. There follow chapters on the basis of dynastic power, with special reference to the Hohenzollern dynasty, the principles of German policy, the subordination of German "Kultur" in the service of dynastic interests, the conception of the "Vaterland" as developed by the imperialists, the underlying forces which animate the nations involved in the present conflict, and the book closes with a stirring call to the German people to rouse themselves from their hypnotic trance and press onward to democracy. It is a splendid book, and is to be cordially recommended to those who desire to understand the psychology of the German people at the present time.

ELEANOR A. MCC. GAMBLE, Editor. *Wellesley College Studies in Psychology, No. 2.* Psychological Monographs, Vol. 22, No. 4, 1916. Whole No. 96. Pp. 192. $2.00.

This volume contains four studies, three of them dealing directly with the learning process. The first study is by Dr. Helen D. Cook and Miss Florence M. Kunkel, and brings out the fact that the contrast colors differ from the complementary in the case of the primary colors red, yellow and blue. For green the contrast and the complementary are approximately the same. The second study, conducted by Professor Gamble and Miss Wilson, showed that both in learning and in recall of nonsense syllables associations of spatial position play an important role. From the third study, by Professor Gamble, and the fourth, by Miss Josephine N. Curtis, it would appear that each learner has an optimum rate of learning, which differs with different individuals, and which gives the best results both in tenacity of retention and in exemption from fatigue.

KATE GORDON. *Educational Psychology.* New York: Henry Holt and Company, 1917. Pp. vi, 294.

In this book we have another attempt "to apply the methods and facts known to psychology to the questions which arise in pedagogy." The author tells us that an elementary knowledge of psychology is presupposed, though why this should be necessary apart from the regulations of certain institutions it is difficult to see. Certainly the text is not so involved as to require such a preliminary study for its mastery. A glance over the chapter headings leads one to suspect that the author, as is customary in such attempts at "application," has not got very far from the traditional course in introductory psychology. We find such rubrics as growth, instinct, motor capacities, sensory capacities, learning, observation, memory, reasoning, the syllogism, transfer of training, attention, feeling, and will. The last three chapters deal with language, drawing and arithmetic, but no mention is made of the recent experimental work in the measurement of attainments in these subjects. Many interesting class exercises and well-chosen illustrative materials make the book valuable to the teacher of psychology, but it is rather irritating to find a writer on "educational psychology" so completely ignoring the rapidly growing science of educational measurements.

MAXIMILIAN P. E. GROSZMANN. *The Exceptional Child.* New York: Charles Scribner's Sons, 1917. Pp. xxxiii, 764. $2.50.

The author uses the term "exceptional" child in its broadest sense to include all types of deviation from the "average," whether up or down. He tries to give a perspective of the entire situation, including questions of heredity and family history, of environment and social-economic conditions, of child hygiene and public sanitation, of medical inspection and clinical work, and of psychologic and psychopathic investigation. There is a chapter on the normal

child and another on exceptionally bright children, and the remainder of the discussion is taken up chiefly with the problems presented by those below the normal. In the chapter on Binet Tests no mention is made of the Stanford revision, and the entire attitude is one of negative criticism. In the list of tests used by the author we find the customary ear and eye tests, color perception, visual and auditory memory, tactile, smell and taste tests, motor coordination, sense of location, balance, controlled association, imitation (Knox Cubes), concentration, language, puzzles, ciphers, reading, writing, Courtis arithmetic tests, Healy form boards, drawing and construction tests. It is obvious that these are applicable only to individual, not to group testing. An appendix of 200 pages contains a medical symposium on a typical children, and a 27 page bibliography.

H. L. HOLLINGWORTH AND A. T. POFFENBERGER, JR. *Applied Psychology.* New York: D. Appleton and Company, 1917. Pp. xiii, 337. $2.25.

For centuries psychology was scarcely more than metaphysical speculation about the way we come to know things. In the last generation it appropriated experimental methods and became a descriptive, if somewhat formal, science. Now the advance outposts proclaim that the function of psychology is to enable us to foretell what response an individual with a given heredity and a given previous training will make to a given situation. From this point of view all psychology is applied psychology. In the present volume, however, the authors are scarcely so ambitious, but select for their special consideration such topics as heredity, efficiency and learning, environmental conditions of efficiency, work, rest and fatigue, drugs and stimulants, business and factory management, the psychology of the worker, and psychology in its relation to salesmanship, law, medicine, social relief, and education. It is more of a program than a handbook of scientifically ascertained facts, but it brings together in convenient form and in the scientific spirit the scattered and fragmentary data that have been discovered in these fields, and thus will contribute materially to the further development of the science.

F. WOOD JONES. *Arboreal Man.* New York: Longmans, Green and Company, 1916. Pp. x, 230. $2.40.

This is an extremely interesting account of an important stage in man's history. It is well established that man came from an arboreal stock. Accepting this view the author raises the further question when did this stock become arboreal, and when did it give rise to a creature which we could possibly call human. In masterly fashion he marshals the evidence from comparative anatomy and physiology bearing upon the question, and gives a vivid and detailed picture of the way in which this change of habitat was carried out, and the resulting consequences upon the evolution of animal structure. Here we see how the fore-limbs became emancipated from the burden of sustaining weight, and gradually developed that mar-

vellous flexibility and deftness to which civilization owes so much in the work of the human hand. The recession of the snout and jaws, the reduction of the teeth, the development of the face and cranium, the poise of the head, the changes in the viscera and in respiration due to the erect position, the enlargement of the brain, the shifting of sensory controls from touch and smell to sight and hearing, and the higher developments of cerebral functions are described step by step, with a welath of pictorial illustration which makes the evidence overwhelming. Such a book is profoundly educative, in that it gives us a better understanding of our origin, and deserves to have the widest possible circulation amongst the educational public.

J. ALBERT KIRBY. *The Kirby Rhythmic Method of Penmanship.* New York: Newson and Company, 1916. Pp. 133.

This writing method is designed to meet the needs of the modern business world. The author is a teacher of penmanship in the High School of Commerce, New York City, and in working out his method has given particular attention to the two requisites of modern business and professional writing, legibility and ease of execution. These are to be attained through emphasis on rhythmic movement in accordance with the developing action and habit systems of the child. The teacher's manual and the accompanying sets of practice pads take account of three natural divisions in the development of writing habits, primary, intermediate, and advanced, depending upon the age and muscular control of the child. The method would seem to commend itself as a logical and well-planned means for securing easy, comfortable, speedy, and legible writing. It is interesting to note that phonograph records have been made to assit teachers in the development of the rythmic idea.

WILLIAM MCANDREW. *The Public and the School.* Yonkers-on-Hudson: World Book Company, 1916. Pp. xii, 76.

This is a new type of school report, and one that deserves to be widely known and imitated. In the first place the report is made in one hundred and eleven pithy and pungent paragraphs. The author has boiled down what he wants to say, and says it directly, effectively, even brilliantly. In the next place the report is illustrated,—not with the graphs and diagrams which we are beginning to associate with statistical reports, but with hand drawn illustrations, hitting off salient features of the discussion in a manner that would do credit to a cartoonist on one of our great newspapers. Finally on almost every page the author avows his faith in testing and measuring results. Not only is it a matter of faith but likewise of works. Accounts are given of ingenious quantitative tests in arithmetic, penmanship, spelling, composition, grammar, and following directions. The finding of Courtis that New York school children rank low in arithmetical accuracy but high in speed is caustically

interpreted, "It takes us less time to get a thing wrong here than it does in the average school system," and is pictorially represented by a huge loaded dray dragged at top speed through the street by straining men and women but with the bundles dropping off in a stream behind. Throughout the report the author advocates efficiency standards, efficiency records, and the recognition of efficient attainments by corresponding rewards. Many of his tests deserve further application and standardization.

FREDERICK WILLIAM HUGH MIGEOD. *Earliest Man.* New York: E. P. Dutton and Company, 1916. Pp. xii, 132.

This admirable little book sketches the evolution of man from his simian ancestry down to the time when he attained the rank of *Homo primigenius.* "The argument is based on his mentality at different stages. Inquiry is made whether his brain is sufficiently developed at a given epoch to admit of its being assumed that he could act in a certain given way, and, inversely, what mental development he must have had when he could manufacture a certain chipped stone." The various chapter headings indicate the scope of the work: The Dawn, Primary Instincts, Proto-man, Progress in the Arts, From Eoliths to Palaeoliths, Origin of Speech, Social Organization, and Appendices giving the cranial capacity of different animals, a chronological table of development, and a hypothetical descent of man. The book gives a splendid picture of the probable steps in the evolution of human civilization, and makes one realize the tremendous reaches of time involved compared with which our historic time is a mere fragment.

WILLIAM HENRY PYLE. *The Science of Human Nature: A Psychology for Beginners.* Boston: Silver, Burdett and Company, 1917. Pp. vii, 229.

There is some warrant for the assumption that the number of text-books and treatises issued in a given department of human knowledge is a fair index of the progress of intellectual activity in that field. According to this criterion there is no doubt that psychology is in a flourishing condition. The present text is designed especially for students in high and normal schools. There is no doubt that a study of human nature would be much more valuable for high school students than many of the subjects on which they spend (or waste) their time. Carefully planned courses in literature, history, government, psychology, and sociology would afford a far more adequate foundation for actual living than the grind on languages and mathematics with which the course of study has been loaded. In this book the author has made such a selection from the entire field of psychology as he thinks will be of value to young people. The general rubrics are the familiar ones of mind and body, inherited tendencies, feeling, attention, habit, memory, thinking, etc., but the treatment is in easy narrative form, the illustrations

are drawn from familiar, every-day situations, and each chapter is followed by a summary, a list of simple class exercises, and a few carefully selected references for further reading. The last two chapters deal with individual differences and applied psychology, and put the student in touch with interesting current developments in experimental psychology.

HAROLD O. RUGG. *Statistical Methods Applied to Education.* Boston: Houghton Mifflin Company, 1917. Pp. xviii, 410. $2.00.

In his introduction the editor well says, "Such a volume forms an interesting exhibit of the progress at present being made in the organization of instruction in the subject of education. Two decades ago there would have been almost no use for such a volume, as we had not then begun to make any accurate measurements of the products of our educational efforts. Only the most general terms were then in use, while today the demand is for quantitative expression in commonly used terms which students can understand." The author's aim is to make clear to school administrators whose training in mathematics has not gone much beyond the high school the statistical and mathematical treatment of school records and experimental studies of school attainments. The introductory chapter on the use of statistical methods emphasizes the importance of the graph, and gives many illustrations of the plotting and interpretation of graphs. The various sources of educational data are next considered, and methods and mechanical devices for tabulating these data are extensively described. The statistical classification of data with reference to attributes and variables is then discussed, and the terms "scale," "unit," "class-interval," and "frequency distribution" are explained and exemplified. The significance of such indications of central tendency as the "mode," the "median" and the "mean" is made clear, measures of variability as range, quartile deviation, standard deviation and mean deviation are expounded, the usefullness of the frequency curve in educational measurements is emphasized, and there is an extended treatment of the various indices of correlation. The book will not supplant Thorndike's pioneer work "Mental and Social Measurements," but on account of the detailed explanations and the richness of illustration will be a valuable supplement to it.

WALTER ROBINSON SMITH. *An Introduction to Educational Sociology.* Boston: Houghton Mifflin Company, 1917. Pp. xvii, 412. $1.75.

The study of social institutions is growing steadily in favor, and the recognition of education as one of the most important of these institutions is an indication of the drift of public sentiment. We have not yet reached clearness in the fundamental aims of education. The old competitive individualism is gradually giving way to the conception of the individual as a member of a social group,

and ideals of group welfare are becoming more and more dominant in our educational policies. It is well to have this systematically set forth in a volume on educational sociology. The first ten chapters of the book sum up the essential principles of sociology that are significant for education. There is a discussion of social organization, of the individual and the social group, of such primary social groups as the family, the play group, and the community, of intermediate groups as the labor unions, clubs, scientific and literary societies, and religious organizations, of the relation to the state and to democracy, and of the evolution of the modern school. In part II we have the educational applications of these fundamental principles. Social and educational surveys, social aspects of school administration, the socialization of discipline and the curriculum, the social basis of utilitarian and vocational education, cultural aspects of a socialized education, and the socialization of teaching methods are the chief topics considered. The book will have a stimulating influence on educational thought.

LEWIS M. TERMAN, and Others. *The Stanford Revision and Extension of the Binet-Simon Scale for Measuring Intelligence.* Educational Psychology Monographs, No. 18. Baltimore: Warwick and York, 1917. Pp. 179. $1.40.

This monograph presents the detailed, long-awaited account of the Stanford Revision. There is a brief history of the studies on which the revision is based, a list of the tests used, an examination of the distribution of intelligence for different ages, a consideration of the rate of growth and the validity of the intelligence quotient, a study of sex differences, an estimation of the relation of intelligence to social status and to school success, a critique of the validity of the individual tests, and a discussion of the fundamental principles involved in the formation of a scale of intelligence. The scale yields a median intelligence quotient of approximately 100 with unselected children of any age from five to fifteen. The expression of mental age in absolute years has no significance and should be abandoned in favor of the intelligence quotient. This remains fairly constant for a child of any grade of intelligence until well into adolescence, and there is no evidence of "nascent stages" or "adolescent spurt." The girls seem to be slightly superior to the boys at each age up to thirteen, although in some tests the boys are uniformly superior. There is nothing to support the widespread belief that extremes of intelligence are more common among boys than among girls. There is a marked correspondence between social status and intelligence, and this seems to rest upon original endowment rather than upon environment. The correlation between teachers' rankings and intelligence quotient was .48, an index high enough to warrant more extensive use of the scale in school diagnosis and classification.

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